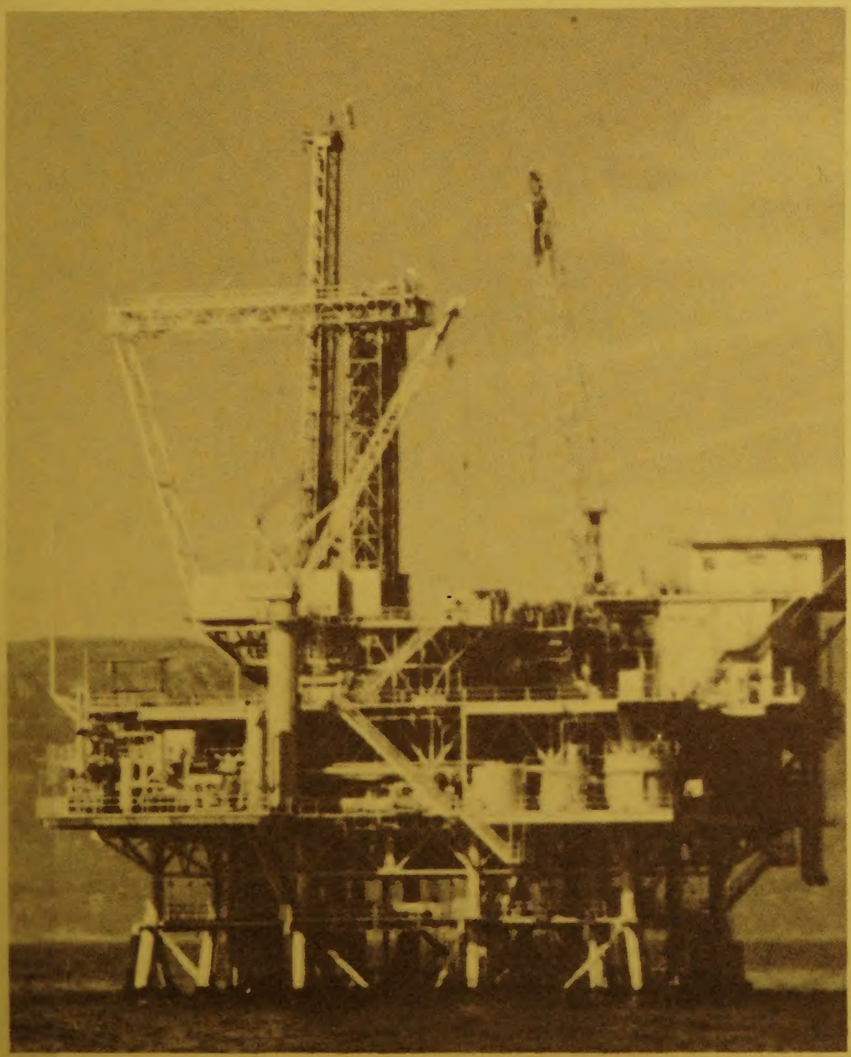
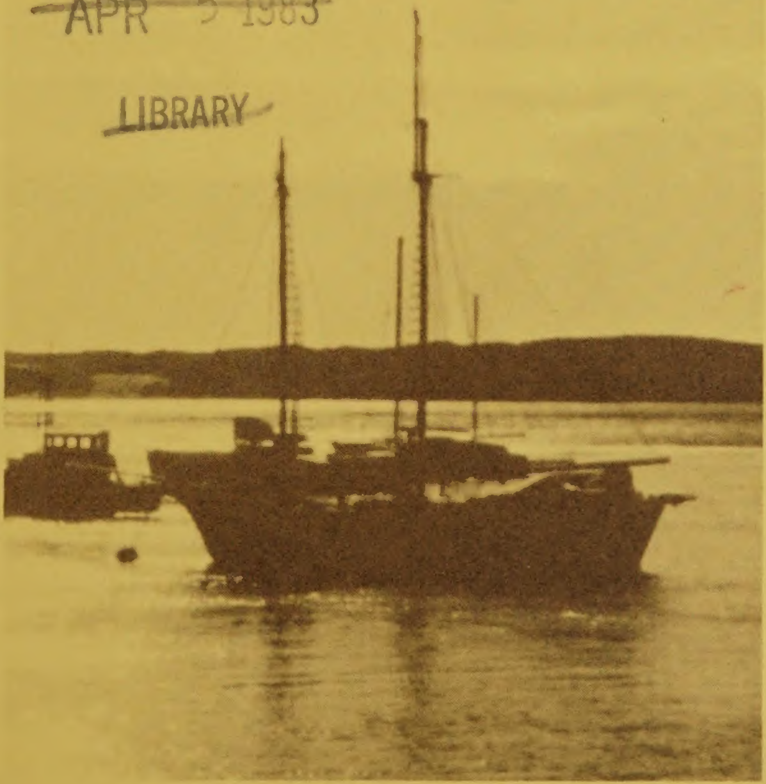
DEPARTMENT OF THE INTERIOR / MINERALS MANAGEMENT SERVICE

DRAFT ENVIRONMENTAL IMPACT STATEMENT

OCS SALE NO. 73

PROPOSED 1983 OUTER CONTINENTAL SHELF
OIL AND GAS LEASE SALE OFFSHORE
CENTRAL CALIFORNIA





Prepared by the Minerals Management Service
Pacific OCS Region
1340 West Sixth Street, Los Angeles, California 90017

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

PROPOSED 1983
OUTER CONTINENTAL SHELF OIL AND GAS LEASE SALE OFFSHORE CENTRAL CALIFORNIA

OCS SALE NO. 73

Prepared by the Minerals Management Service
Pacific OCS Region
1340 West Sixth Street, Los Angeles, California 90017

DEPARTMENT OF THE INTERIOR / MINERALS MANAGEMENT SERVICE

March 1983

DRAFT ENVIRONMENTAL IMPACT STATEMENT
Proposed Outer Continental Shelf Oil and Gas Lease
Sale No. 73 Central California

SUMMARY

I. Preliminary Information

Proposed OCS Oil and Gas Lease Sale No. 73 Central California

Type of Action:

Administrative (x)   Legislative ( )

Lead Agency:

United States Department of the Interior
Minerals Management Service
Pacific Outer Continental Shelf
1340 W. Sixth Street
Los Angeles, CA 90017

Contacts:

John Lane or Debra Agnolet
Minerals Management Service
1340 W. Sixth St.
Los Angeles, CA 90017
(213) 688-6748

Dan Henry
Minerals Management Service
18th & C Street, N.W.
Washington, D.C. 20240
(202) 343-6264

II. Description of the Area and Proposed Action

The proposed action (Alternative I) is offering for leasing those unleased tracts from Point Conception through Row N 816 UTM Grid System and within the boundaries of the Call for Nominations and Comments. The proposed action has been designated as Proposed OCS Oil and Gas Lease Sale No. 73 Central California, and is currently scheduled for October 1983. The tracts are located 3 to 66 miles offshore in water depths ranging from 50 to over 1,000 meters (see Figure II. A.1.a-1. Approximately 2 million acres (814,000 hectacres) or 360 tracts are located within the boundary of the proposed sale area. Situated within the proposed sale area are 55* leased tracts from OCS Sale No. 53, and 10 leased tracts from RS-2. In the unlikely event any of the previously leased tracts are relinquished prior to the sale, they will be considered for leasing.

*the decision on acceptance of 19 bids received from OCS Sale No. 53 is pending results of litigation.

The analysis of expected impacts for Alternative I and subsequent Alternatives are based upon the Most Likely Resource Estimates, associated exploration, development and production, and Transportation Scenario No. 1. The Most Likely Resource Estimates and associated development and transportation scenarios in conjunction with the development from other projects and proposals within the proposed sale area and development from existing leased tracts provide the basis for the analysis of potential cumulative impacts. The Conditional Mean Resource estimates, associated development and transportation scenarios provide the basis for a "High Case" analysis.

RESOURCE ESTIMATES

	BBO	TCFG
Most Likely Resource Estimate	0.291	0.285
Conditional Mean Resource Estimate	0.970	0.950

III. Issues and Areas of Concern

As authorized by the OCS Lands Act, as amended, the Department of the Interior serves as the primary Federal agency administering leases on the Outer Continental Shelf. Department of the Interior agencies are in constant coordination with each other throughout the presale processes and the production phases, as well as coordinating as appropriate with other Federal, State, local, and non-governmental agencies and organizations. The scoping process and coordination with other Federal agencies identified the following environmental issues and areas as requiring special attention and emphasis in the environmental assessment process:

Physical Environment

General Issues
Geologic Hazards
Water Quality
Ocean Dumping
Air Quality

Biological Environment

General Issues
Intertidal Benthos
Subtidal Benthos
Fish
Marine Mammals
Seabirds
Endangered and Threatened Species
Estuaries and Wetlands
Areas of Special Concern
Point Reyes/Marine Sanctuaries

Socioeconomic

General Issues
Demography
Coastal Economy
Public Services and Facilities
Coastal Land Use
Commercial Fisheries
Sportfishing
Recreation Tourism
Visual Resources
Cultural Resources
Ports and Harbors
Marine Traffic
Refineries
Offshore Structures
Military Uses

IV. Alternatives

A. Alternative I (Proposed Action)

The analysis of expected impacts were based upon the Most Likely Resource Estimates, associated Exploration, Development and Production of the resources, and Transportation Scenario No. 1 (Yamasaki, 1983). All applicable laws, regulations and Pacific OCS orders (see Section I.D. and E and Section IV.B) were considered in place during the analysis. A detailed discussion of the expected impacts is presented in Section IV.E. In the analysis, oil spills were assumed expected when the Oil Spill Analysis Model predicted a 25 percent probability or greater of one or more spills occurring and contacting land segments or targets.

The actual environmental risk may prove higher or lower due to the extremely difficult nature or predicting oil spills and their movements, and the many parameters called for by the model. Therefore, potential impacts as a result of an oil spill are also presented in Section IV.E.

With the exception of imapcts to issues discribed below the analysis of the issues listed above were found to have low or very low impacts as a result of the proposed action.

Physical Environment. Moderate air quality impacts were predicted for coastal regions adjacent to the proposed sale area. It is likely, therefore, that OCS facilities associated with Proposed Sale No. 73 would be required under Department of Interior air quality regulations to apply emission controls. Application of emission controls would reduce the predicted impacts to low.

Biological Environment. The Channel Islands National Marine Sanctuary is expected to experience impacts from an oil spill. As a result of this expected spill, California seabird species and the northern fur seal are expected to receive impacts. Impacts to the California seabird populations are expected to be moderate (2-15 percent mortality of the California population of a species) due to an oil spill expected to contact the buffer zone around the northern Channel Islands. The California northern fur seal population is expected to have a high impact (25 percent mortality of the California population) if a spill occurs during spring and summer pupping or breeding season.

Socioeconomic Environment. Public Services and Facilities. The impacts to public services and facilities would be moderate, that is, short-term stress of local systems that may be accommodated through time and with small use adjustments. Expected impacts to water supply systems would be high for the proposed sale area.

High impacts to Port San Luis would be expected, primarily due to competition for vessel berth space and support facilities. This competition would lead to the need for additional docks, berths, and facilities.

B. Alternatives to the Proposed Action

1. Alternative II. Modify the Sale to Protect Sensitive Biological Areas (Morro Bay)

2. Alternative III. Delay the Sale

3. Alternative IV. No Sale

IV. Comments

During the comment period for the Draft EIS for Sale No. 73, the EIS staff will be summarizing and evaluating comments for inclusion into the Final EIS.

The most useful comments during this process, supplement or improve the analysis presented within the document. Sources of information would be helpful, if provided,in order to enable the resource specialist to re-evaluate the information as it pertains to the resource.

A Final EIS will be sent to government agencies, and interested groups and individuals who submitted comments or request a copy of the FEIS for Proposed Sale No. 73.

TABLE OF CONTENTS

PURPOSE AND NEED FOR ACTION

I.

CHAPTER I

I. PURPOSE AND NEED FOR ACTION

A. Purpose and Need for Action

The Federal government is authorized by Section 102(2) of the Outer Continental Shelf Lands Act, as amended, to:

> preserve, protect, and develop oil and natural gas resources in the Outer Continental Shelf in a manner which is consistent with the need (A) to make such resources available to meet the nation's energy needs as rapidly as possible, (B) to balance orderly resource development with protection of the human, marine, and coastal environments, (C) to insure the public a fair and equitable return on the resources of the Outer Continental Shelf, and (D) to preserve and maintain free enterprise competition.

The purpose of this environmental impact statement (EIS) is to aid in fulfillment of Section 102(2)(B) and the requirements of the National Environmental Policy Act by making environmental information available to public officials and citizens before decisions are made with respect to Proposed Sale No. 73.

As required by Section 801 of the Department of Energy Organization Act, the Department of Energy submitted to the Congress in July 1981 a report entitled, The Nationa l Energy Policy Plan. In reference to Federal Lands, the plan states, "The Federal role in National energy production is to bring these resources into the market place, while simultaneously protecting the environment." The proposed 5-year OCS oil and gas leasing program is an essential component of this Federal role. The fundamental purpose of the OCS program, as viewed in the context of national energy policy, is to discover, identify, and inventory those oil and gas resources that lie beneath the ocean within Federal jurisdiction, and to allow for the timely and efficient development of those resources.

The Federal OCS constitutes the last major frontier for domestic petroleum and natural gas exploration. The United States Geological Survey (USGS) estimates that the total U.S. OCS may contain 34 percent of the mean conventionally producible undiscovered recoverable oil resources within a water depth of 2,500 meters along with the 28 percent of the similarly defined natural gas resources (USGS, 1981). To a large extent, OCS areas around all United States coastlines consist of sedimentary basins which contain hydrocarbonbearing formations.

This EIS and the environmental review process are structured to assess the potential impacts to the environment of oil and gas operations in the proposed sale area. The facility locations and transportation scenarios described represent assumptions that were made for purposes of analysis and serve as a basis for identifying characteristic activities and any resulting environmental impacts and multiple-use conflicts. These assumptions do not represent a recommendation, preference, or endorsement of any facility, site, or development plan. This EIS should not be construed as, or used for, a local planning document. Local control of some events may be exercised through applicable State and local laws and ordinances regarding land ownership, planning, and zoning.

B. Administrative Events Leading Up to the Proposal

The OCS Lands Act, as amended, gives the Department of the Interior the responsibility for administering mineral development on the OCS. The process by which oil and gas resources are leased for development is multi-phased with many opportunities for interaction from Federal agencies, State and local governments, concerned citizens, groups, and industries. The steps in Proposed Sale No. 73 leasing process are a combination of administrative events of two processes the administrative process in place prior to July 1982 and "streamlining". A discussion of the new process of "streamlining" can be found in the Final Supplement to the Final Five Year Leasing Schedule EIS (BLM, 1982). All steps legally required and mandated will occur during the process of offering for lease areas off Central California. The administrative steps as they have taken or will take place for Proposed Sale No. 73 are as follows:

1. Oil and Gas Leasing Schedule: The OCS Lands Act, as amended, requires the Secretary of the Department of the Interior to prepare "...an oil and gas leasing program...(which) shall consist of a schedule of proposed lease sales indicating...the size, timing, and location of leasing activity which...will best meet national energy needs for the 5-year period...."

The current 5-year schedule covers the years 1982 to 1987 and was approved July 1982. It replaces the program approved in June 1980 covering the period time from mid-1980 through mid-1985. On October 6, 1981, the U.S. Court of Appeals for the District of Columbia Circuit issued a decision on litigation involving the 5-year program adopted in June 1980. The court remanded the June 1980 program and its administrative record for revision in accordance with the OCS Lands Act. The tentative proposed final program was announced March 15, 1982, in accord with the court's October 6, 1981 order and a subsequent January 19, 1982 clarification order. The proposed final program was submitted May 11, 1982 to the President and the Congress for a 60-day notification period.

Environmental Impact Statements were prepared for both schedules. The Final Environmental Impact Statement (FEIS) for the June 1980 schedule was released to the public in January 1980. The Final Supplement to the FEIS was released March 1982, and covers the July 1982 schedule. The Final Supplement discusses the differences between the anticipated environmental impacts of the June 1980 schedule and the July 1982 schedule. It also presents a discussion of streamlining.

The 5-year OCS leasing program does not represent a decision to lease in a particular area. It represents only the Department's intent to consider leasing certain areas, and to proceed with the leasing of such areas if it should be determined that leasing and development in such areas would be environmentally acceptable and technically feasible.

2. Request for Resource Reports: On July 31, 1980, the Bureau of Land Management (BLM) sent requests for resource reports to 52 agencies and groups. Information was requested on resources and other uses of the OCS from the U.S.-Mexico International Boundary to the California-Oregon State boundary and the possible impacts from oil and gas exploration and development. Suggestions for resolution of any conflicts were also requested. Responses were received from eleven Federal agencies, four State agencies, thirteen counties and one city (Refer to Section V Consultatin and Coordination).

3. Call for Nominations and Comments: On November 11, 1980 the Bureau of Land Management published in the Federal Register (45 F.R., 79402, November 11, 1980) a Call for Nominations and Comments. The Call area extended from the U.S.A.-Mexico Border to the Oregon-California boundary and included approximately 4,500 blocks covering 24.1 million acres. Water depths ranged to 12,000 feet (3,800 m). Areas excluded from the call were: 1) Dana Point. to San Diego; 2) Channel Islands National Marine Sanctuary; 3) tracts in the northern basins, Eel River, Point. Arena, Bodega, and Santa Cruz; 4) Point. Reyes Wilderness Area; 5) tracts within 3 miles of State waters from Point Ano Nuevo to Point Sur; and 6) Point Reyes/Farallon Islands Marine Sanctuary. Fifteen companies submitted nominations and 1,680 written comments including 1,543 post cards, were received.

4. Area Identification: On May 5, 1982 DOI announced the study area for the Proposed Sale No. 73 Environmental Impact Study to be limited to areas three to 75 miles offshore California, from Point Conception north to the California-Oregon State line. Deleted from the study area were tracts in the Eel River, Point Arena, Bodega and Santa Cruz Basins, blocks in areas surrounding the Farallon Island Marine Sanctuary, Point Reyes Wilderness area, and blocks within three miles of State waters from Point Ano Nuevo to Point Sur. A map depicting the study area was released. No itemized listing of the tracts or the blocks comprising the study area was made.

5. Notice of Intent and Scoping: On December 30, 1982 a Notice of Intent (NOI) to prepare an EIS was released for Proposed Sale No. 73. The NOI announced that the EIS would focus on the potential impacts of leasing, exploration and development in the southern portion of the Santa Maria Basin. This provided the opportunity for Federal, State, and local governments and agencies, industry, organizations and individuals to submit comments on the scope and issues needed to be addressed in the EIS. Comments were due January 31, 1983, 725 comments were received. See Section I.F. for an analysis of the scoping process.

6. Draft EIS and Subsequent Public Hearings: The DEIS considers all data and information available up to this time and evaluates potential effects of the action on the marine environment, air quality, recreation, cultural resources, and socioeconomics in the area. The DEIS is made available for public review and public hearings are then held.

7. Section 7 Consultation, Endangered Species: As required by the Endangered Species Act of 1973, as amended, MMS is consulting with FWS and NMFS to ensure that Proposed Sale No. 73 is not likely to jeopardize the continued existence of endangered or threatened species, or destroy or adversely modify the critical habitat of such species. The biological opinions to be provided by FWS and NMFS will be included in the FEIS. Consultation will be continued until all issues are resolved. As required under the Endangered Species Act of 1973, as amended, Section 7 consultation will continue, as needed, and as may be related to development and roduction phases of the proposed sale.

8. Final EIS and Proposed Notice of Sale: The FEIS will reflect Department of the Interior's consideration of all comments received from the public and Federal, State, and local officials. The Final Impact Statement is filed with the Environmental Protection Agency and a 30-day waiting period must follow before any decision is possible. None of the steps outlined above constitutes a decision to hold a sale. A Proposed Notice of Sale, published after the EIS is finalized, contains information on blocks or tracts tentatively considered for sale. Also in the Proposed Notice is a listing of the stipulations proposed to be attached to any individual block or tract.

9. Coordination with State: Section 19 of the OCS Lands Act, as amended, provides for coordination and consultation with affected State and local governments. If the Secretary of the Interior makes a preliminary decision to hold a sale, the Governor of the affected State may submit recommendations to the Secretary regatding, the size, timing, or location of the proposed lease sale. Such recommendations are submitted within 60 days after the publication of the Notice of Sale in the Federal Register. Thereafter, the Secretary of the Interior will respond to the "...Governor's recommendations, or ... implement any alternative means identified in consultation with the Governor to provide for a reasonable balance between the national interest and the well-being of the citizens of the affected State".

10. Notice of Sale: If a final decision to hold the sale is then made by the Secretary of the Interior, he will specify what tracts or blocks shall be offered and what terms and conditions are to be imposed on lease purchasers. The Notice of Sale is published in the Federal Register at least 30 days prior to the Sale. Under the current OCS planning schedule, the Notice of Sale for Proposed Sale No. 73 would be issued in September 1983.

11. Sale: Outer Continental Shelf oil and gas lease sales are open to the public. Under the current OCS schedule, Proposed Sale No. 73 is scheduled for October 1983. However, this schedule is subject to revision by the Secretary of the Interior.

12. Activity After a Sale: Continued formal and informal contacts with the State for future planning and discussion of onshore facilities are conducted, as well as coordination under Department of the Interior Manual 655 with FWS and NPS. Further information is provided in Section I.B.7.

13. Environmental Monitoring: Minerals Management Service (MMS) will consider environmental monitoring studies for the areas leased as a

result of a sale. Each area will be evaluated on a case-by-case basis to design an effective monitoring program responsive to management questions. Special monitoring studies may be required for areas identified as having a special resource value. Appropriate State officials are contacted on a continuing basis in a consulting capacity. MMS will provide for a free flow of information to keep the State informed of the status of any monitoring program. The State will be informed through the OCS Advisory Board, through State liaison officers, and through the activities of the Pacific Outer Continental Shelf Regional Office.

C. Leasing History

The leasing history for offshore Central and Northern California is presented on Graphic No. 1, Leasing History. This graphic shows all tracts which have been, or are currently, leased and those tracts which have been deleted from consideration for Proposed Sale No. 73 and previous Sales. The numbers of tracts offered, leased, and terminated are presented in Table IV.C.3-1. Tracts deleted from one sale may have been considered for lease in a subsequent sale. A listing of these deleted tracts and the reasons for their deletion from the proposed sale is presented in Appendix B.

Offshore oil and gas exploration and development in California began in 1896 with the first shallow well being drilled from a pier offshore Summerland in Santa Barbara County. In 1929, the State of California began issuing oil and gas leases for submerged lands offshore California. However, it was not until May 14, 1963 when the first Federal oil and gas lease Sale was held in the Pacific Region.

1963 Sale. The Call for Nominations for the 1963 sale covered 4 million acres off the coast of Central and Northern California. From the 174 tracts nominated, 129 tracts were offered for lease. The tracts were grouped in four areas adjacent to Eureka, Point Arena, San Francisco, and Morro Bay. Fifty-seven of the 129 tracts offered were leased in the sale.

All the leases from the 1963 Sale were relinquished between 1965 and 1967.

Sale No. 53. On May 28, 1981, the second oil and gas lease sale for Central and Northern California (OCS Lease Sale No. 53) which included portions of the areas previously offered and leased in the 1963 Sale, was held. Twenty-seven oil companies nominated 1,743 blocks or approximately 8.4 million acres of submerged land. Of the nominated tracts, only 242 tracts comprising 1.3 million acres were considered in the Final EIS prepared for Sale No. 53.

California, five State agencies, and a coalition of environmental groups filed suits (State of California, et al., v. Watt Civil No. 81-2080 and Natural Resource Defense Council Inc. et al., v. Watt Civil No. 81-2081) to enjoin the Secretary of the Interior from conducting the oil and gas lease sale for 32 of the tracts. A temporary injunction to enjoin DOI from accepting or rejecting any bids or issuing any leases on the 32 litigated tracts was issued on May 27, 1981 by the U.S. District Court for the Central District of California. The sale was held as planned on May 28, 1981 and fifty-five leases were issued with an effective date of July 1, 1981.

On July 27, 1981, the U.S. District Court for the Central District of California, held that the Secretary's decision to lease in the northern portion of the Santa Maria Basin was made in violation of the Coastal Zone Management Act of 1976. DOI was permanently enjoined from awarding any leases for any of the tracts at issue, until DOI complied with the requirements of the Coastal Zone Management Act. DOI appealed the decision to the Ninth Circuit Court.

On August 12, 1982, the U.S. Court of Appeals for the Ninth Circuit affirmed the District Court's decision of July 27, 1981 that the Secretary of the Interior must make the determination that Lease Sale No. 53 is consistent with the California coastal zone management plan to the maximum extent practicable. Interior is continuing the review of the case.

RS-2. On August 5, 1982, a Reoffering Sale (RS-2) was held on tracts located in Central and Northern California, South Atlantic, Lower Cook Inlet/Shelikof Strait, and Mid-Atlantic OCS areas. The Central and Northern California tracts were an offering of past Sale No. 53 tracts, which had not received bids, in which high bids were rejected, or the tracts which were part of the Sale 53 litigation and had not received any bids. The State of California filed suit (State of California, et al., v. Watt Civil No. 82-4304) on July 16, 1982, to prevent DOI from leasing 2 of the 27 tracts being offered. The suit was dismissed by the district court.

Ten of the Twenty seven tracts in the Santa Maria Basin were leased as a result of the RS-2 sale. Two were rejected.

D. Regulatory Framework - The Laws

OCS Lands Act. The Outer Continental Shelf Lands Act of 1953 (67 Stat. 462), as amended in 1978 (P.L. 95-372; 92 Stat. 629), established Federal jurisdiction over submerged lands on the OUter Continenta Shelf (OCS) seaward of State boundaries (generally 3 geographic miles seaward of the coastline). Under the OCS Lands Act, the Secretary of the Interior is responsible for the administration of mineral exploration and development of the OCS. The Act empowers the Secretary to grant leases to the highest qualified responsible bidder(s) on the basis of sealed competitive bids and to formulate such regulations as necessary to carry out the provisions of the Act.

The Act, as amended, provides guidelines for implementing an OCS oil and gas exploration and development program. The basic goal of the Act is to expedite exploration and development of the OCS minerals in order to achieve national economic and energy policy goals, assure national security, reduce dependence on foreign sources of oil, and maintain a favorable balance of payments in world trade. With respect to implementing a leasing program, this goal is constrained by the following considerations: (1) the receipt of fair and equitable return on oil and gas resources; (2) preservation and maintenance of competition; and (3) balancing orderly energy resource development with protection of the human, marine, and coastal environments.

The Secretary of the Interior has designated the Bureau of Land Management as the administrative agency responsible for the leasing of submerged Federal lands, and the Geological Survey (USGS) for the supervision of offshore oper-

ations after lease issuance. Regulations administered by the Bureau of Land Management govern the leasing of mineral deposits on the OCS and the granting of rights-of-way for pipelines and are found at 43 Code of Federal Regulations, Part 3300. Regulations administered by the Geological Survey governing the conduct of mineral operations are contained in 30 CFR Part 250, and are supplemented by OCS operating orders on an area-specific basis.

Major requirements of the Act and its implementing regulations, many of which mitigate adverse impacts resulting from OCS leasing and development, follow:

- In the enforcement of the safety, environmental, and conservation laws and regulations, the Secretary shall cooperate with the relevant departments and agencies of the Federal Government.
- The Secretary is authorized to suspend or temporarily prohibit an operation or activity pursuant to a lease or permit.
- The Secretary is authorized to cancel a lease or permit.
- The Secretary is authorized to issue regulations for unitization, pooling, and drilling agreements.
- The Secretary is authorized to issue regulations to prevent OCS operations from adversely affecting the national ambient air quality standards.
- The Secretary may cancel a nonproducing lease for the owner's failure to comply with any of the provisions of the Act, the lease, or regulations under the Act.
- The Secretary may initiate judicial proceeding to cancel a producing lease because of the owner's failure to comply with any of the provisions of the Act, the lease, or regulations under the Act.
- Rights-of-way may be approved under such regulations and upon such conditions as may be prescribed by the Secretary, assuring maximum environmental protection by utilization of the best available and safest technologies.
- Exploration must be undertaken pursuant to an approved exploration plan. An environmental report is also submitted for review. The environmental report is used by DOI to prepare an Environmental Assessment (EA) or an EIS as necessary. No permit for drilling may be issued until all affected States with approved coastal zone management programs have concurred or been presumed to concur with the consistency determination provided by the lessee.
- Geological explorations on unleased areas of the OCS shall be allowed only if such exploration will not be unduly harmful to aquatic life in the area, result in pollution, create hazardous or unsafe conditions, unreasonably interfere with other uses of the area, or disturb any site, structure, or object of historical or archaeological significance.

- Governors of affected States may submit recommendations to the Secretary regarding the size, timing, or location of a proposed lease sale, or with respect to a proposed development and production plan.

- The Secretary is authorized to enter into cooperative agreements with affected States for several purposes, including but not limited to sharing the information, joint utilization of available expertise, joint planning, review, and permitting procedures, and the formation of joint surveillance and monitoring arrangements relevant to OCS operations, both onshore and offshore.

- The Secretary shall conduct a study of any area or region included in any oil and gas sale in order to establish information needed for assessment and management of environmental impacts on the human, marine, and coastal environments of the OCS and the coastal area which may be affected by oil and gas development in such area or region.

- Subsequent to the leasing and development of any area or region, the Secretary shall conduct additional studies to establish environmental information and shall monitor the human, marine, and coastal environments of such area or region.

- The Secretary shall consider relevant environmental information in making decisions, in developing appropriate regulations and lease conditions, and in issuing operating orders.

- In exercising their respective responsibilities, the Secretary and the Secretary of the Department in which the Coast Guard is operating shall require, on all new drilling and production operations and, wherever practicable, on existing operations, the use of the best available and safest technologies (BAST). The Secretary determines the economic feasibility of utilizing the BAST. Wherever failure of equipment would have a significant effect on safety, health, or the environment the Secretary shall require use of BAST, unless he determines that the incremental benefits are clearly insufficient to justify the incremental costs of utilizing such technologies.

- The holder of a lease or permit shall maintain all operations within such lease area or within the area covered by such permit in compliance with regulations intended to protect persons, property, and the environment on the OCS.

- The Secretary of the Interior, the Secretary of the Department in which the Coast Guard is operating, and the Secretary of the Army shall enforce safety and environmental regulations promulgated under the act. The Secretary and the Coast Guard shall promulgate regulations for on site inspections of OCS facilities.

- Any person having a valid legal interest which is or may be adversely affected may commence a civil action to compel compliance with the OCS Lands Act against any person, including the United States, for

any alleged violation of any provision of the OCS Lands Act, or regulation promulgated thereunder, or terms of any permit or lease issued under the OCS Lands Act.

- The Attorney General or a U.S. Attorney may institute a civil action for a temporary restraining order, injunction, or other appropriate remedy to enforce any provisions of the OCS Lands Act, regulation or order issued under the act or any terms of a lease, license, or permit issued under the act.

- Prior to development and production of an oil and gas lease, the lessee shall submit a development and production plan to the Secretary for approval. An environmental report is also submitted for review. The environmental report is used by DOI to prepare an Environmental Assessment (EA) or an EIS as necessary.

- The Secretary shall disapprove a development and production plan if:

  a. the lessee fails to demonstrate he can comply with requirements of the OCS Lands Act or other applicable Federal law;

  b. activities described do not receive a consistency concurrence by a State with an approved CZM plan;

  c. operations threaten national security or defense; or

  d. (1) exceptional geologic conditions, exceptional values in the marine or coastal environment or other exceptional conditions exist, and that implementation of the plan would probably cause serious harm or damage to life, to property, to any mineral deposits,...or to the marine, coastal, or human environments; (2) the threat of harm or damage will not disappear or decrease to an acceptable extent within a reasonable period of time; and (3) the advantages of disapproving a plan outweigh the advantages of development and production.

- The Secretary shall not grant a license or permit for any activity in an exploration, development or production plan affecting any land or water use in the coastal zone of a State with an approved Coastal Zone Management plan, unless the State concurs or can be presumed to concur with the consistency certification accompanying such plan.

- The Secretary shall, from time to time, review each development and production plan. If the review indicates that the plan should be revised to meet the requirements of Section 25 of the OCS Lands Act, the Secretary shall require such revision.

- The Secretary shall provide affected States with information to assist them in planning for the onshore impacts of possible oil and gas development and production.

° The Secretary of the Department of Transportation shall administer the Offshore Oil Spill Pollution Fund establishing compensation for injuries caused by oil discharge from an offshore facility or vessel.

° The Secretary of the Department of Commerce shall administer the Fishermen's Contingency Fund which provides compensation for damage to fishermen's gear or vessels resulting from oil and gas exploration, development, and production.

Other laws that effect the OCS are the Endangered Species Act of 1973, the Clean Air Act of 1955, Coastal Zone Management Act of 1972, Marine Mammals Protection Act of 1972, Fish and Wildlife Coordination Act, Deepwater Port Act of 1979, and Port and Water Safety Act of 1978, to name just a few. These acts provide for the protection and safe use and development of the oceans and its resources.

E. Regulatory Framework - Agencies

Various Federal agencies have regulatory responsibilites that affect the OCS leasing program.

Department of the Interior. The Minerals Management Service is the Department of Interior agency with direct OCS regulatory and enforcement authority. MMS implements the OCS leasing regulations under 30CFR256 and operates with other Federal agencies to develope special stipulations that apply to either specific leases or all leases within the proposed lease areas. These stipulations address such matters as cultural and biological resources, pipeline rights-of-way, disposition of drilling wastes, and equipment identification. In addition to issuing leases, MMS issues rights-of-way for pipelines on the OCS which are not wholly contained within the boundaries of contiguous leases of the same owner or operator.

MMS also administers regulations governing lease operations, including exploration and development of the OCS under 30 CFR Part 250. These regulations are the basis for OCS Orders which apply to operations in the proposed lease area. See Section IV.B.1 for a discussion of OCS Orders for the proposed lease area. Additionally, USGS maintains jurisdiction over producer-owned gathering lines and flowlines on the OCS. These are pipelines restricted to a leasehold or unit.

The Department of the Interior has promulgated regulations describing a program for regulating air pollution from OCS operations. The final regulations which became effective as of June 2, 1980, were published in the Federal Register on March 7, 1980 and are codified as 30 CFR 250.57.

The U.S. Fish and Wildlife Service (USFWS) shares responsibility with other agencies for protection of fish and wildlife resources and their habitats, and acts in an advisory capacity in the formulation of OCS leasing stipulations. USFWS also provides recommendations to the Corps of Engineers in the issuance of Federal permits to industry for construction of navigable waters. USFWS is responsible for the protection and stewardship of certain species covered under the Endangered Species Act of 1973, as amended.

U.S. Army Corps of Engineers. The OCS Lands Act extends to the OCS the authority of the Secretary of the Army to prevent obstruction to navigation in U.S. navigable waters. Section 10 of the Rivers and Harbors Act of 1899 requires that permits be issued for all offshore construction, including pipelines, in U.S. navigable waters.

Permits must also be issued for onshore facilities in which dredging and filling of U.S. navigable waters are involved. Structure permits for exploratory drilling vessels and for fixed and mobile platforms are issued by the Corps. Permits for structures in State waters must consider environmental requirements before the issuance pursuant to Section 404 of the Clean Water Act. Section 404 also delegates regulatory authority to the Secretary of the Army over discharge of dredged or fill material in wetlands.

Department of Transportation. The OCS Lands Act grants authority to the Coast Guard to promulgate and enforce regulations covering lighting and warning devices, safety equipment, and other safety-related matters pertaining to life and property on fixed OCS platforms and drilling vessels. Through the Coast Guard, the Department of Transportation (DOT) advises the Corps of Engineers on the issuance of permits and the placement of offshore structures. Under the Port and Waterways Safety Act of 1978, the Coast Guard has the authority to establish shipping safety fairways and other ship routing systems in which OCS structures may be prohibited. The Coast Guard also has jurisdiction to enforce the Clean Water Act on the OCS.

Under the Clean Water Act, the U.S. Coast Guard approves the procedures to be followed and the equipment used for the transfer of oil from vessel to vessel and between onshore and offshore facilities and vessels. The Coast Guard also conducts pollution surveillance patrols to detect oil discharges within territorial and contiguous waters and has enforcement authority over violations. The Coast Guard also has strike team responsibilities should an oil spill occur.

The Materials Transportation Bureau (MTB) is responsible for establishing and enforcing design, construction, operation, and maintenance regulations for pipelines. The Department of Transportation's responsibility and authority is further defined in a Memorandum of Understanding between it and the Department of the Interior.

Department of Commerce. The Department of Commerce, through the National Oceanic and Atmospheric Administration (NOAA) and the National Marine Fisheries Service (NMFS), is responsible for protection of marine fishery resources and their habitats, and for providing recommendations to the Corps of Engineers regarding the issuance of permits in navigable waters. NOAA participates in making recommendations to the MMS pertaining to OCS leasing and development through a Basic Agreement for Program Coordination. MMS participates in a number of NOAA activities under the same Basic Agreement.

The Department's responsibility and authorities related to OCS development include the Fishery Conservation and Management Act of 1976, the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, the Fur Seal Act of 1966, Title II of the Marine Protection, Research, and Sanctuaries Act of 1972 ("Comprehensive Research on Ocean Dumping"), and the National Ocean Pollution Research and Development and Monitoring Act of 1978.

The Department of Commerce also administers the Coastal Zone Management Act (CZMA) of 1972, as amended, through the National Oceanic and Atmospheric Administration. The CZMA encourages the development and implementation of coastal management programs for the sound management of State coastal resources by providing a system of grants, loans, and loan guarantees to the States. Once developed, the program is then submitted to the Secretary of Commerce for approval after which the Coastal Management Program (CMP) may be implemented. California has an approved CMP which is currently being implemented. Section I.B.8.a of this document provides additional information.

Section 307 of the CZMA contains the Federal consistency provision which imposes certain requirements on Federal agencies to comply with approved State coastal zone management programs.

Section 307(c)(1) requires Federal agencies conducting or supporting activities directly affectingthe coastal zone be consistent to the maximum extent practicable with a State's coastal program. NOAA's Federal consistency regulations (15 CFR 930.30-.44) require Federal agencies to review each activity to assess whether it would "directly affect" the coastal zone of a State with an approved CZM program. If the Federal activity would have direct effects, the Federal agency must prepare a consistency determination and submit it to the State. If the Federal activity would have no direct effects, the Federal agency is to make a negative determination.

In States with an approved CMP, Federal agencies are prohibited (Section 307(c)(3)(A)) from issuing licenses/permits for any activity in the coastal zone that might affect land or water uses, unless the proposed activity is consistent with the CMP. In cases of inconsistency, the Secretary of Commerce may override the State's objection.

Section 307(c)(3)(B) requires that no Federal license or permit for an activity described in detail in an OCS exploration plan or development and production plan which affects a land or water use in the coastal zone of a State with an approved CMP may be approved until the State has concurred with the consistency determination made by the lessee or the Secretary of Commerce has overridden the State's objections.

Finally, under Section 307(d), Federal agencies may not provide Federal assistance for proposed projects that are inconsistent with a State's coastal management program except upon certain findings by the Secretary of Commerce.

Department of Energy. With respect to Outer Continental Shelf leasing, and in consultation with the Secretary of the Interior, the Department of Energy (DOE) is authorized under the Department of Energy Organization Act of 1977 to foster increased competition for leases, to implement authorized systems of bidding, to establish due diligence requirements for OCS operations, to set rates of production, and to determine amounts of OCS gas purchased and transported. DOE has broad authority over approval, design, and economies of common carrier gas pipelines.

In addition, the Department of Energy provides support to the Leasing Liaison Committee, whose function is to coordinate leasing policies of the Department of the Interior with DOE policies.

The Federal Energy Regulatory Commission (FERC), within DOE, has the authority under the Natural Gas Act to issue certificates of public convenience and necessity for proposed projects involving the transportation or sale of natural gas in interstate commerce. All natural gas produced from the OCS is considered to be interstate and therefore, is subject to FERC jurisdiction. The Natural Gas Act, the National Environmental Policy Act, and OCS Lands Act Amendments of 1978 all grant authority for or require that the FERC investigate the environmental effects of a proposed offshore project, as well as the potential gas reserves, the need for this gas, and the availability of capital to develop this resource. Also, the FERC is primarily responsible for administering and enforcing the Natural Gas Policy Act (NGPA) of 1978. As applied to OCS matters, the NGPA provides new wellhead pricing controls for certain natural gas produced from the OCS.

Environmental Protection Agency. Under the Federal Water Pollution Control Act (FWPCA) Amendments of 1972, a National Pollution Discharge Elimination System (NPDES) was created and applies to discharges into the territorial seas, waters of the contiguous zone, and the oceans. The NPDES applies to fixed platforms and drillships, and any discharges from these sources would require a permit issued by the Environmental Protection Agency (EPA). Discharges of pollutants without the necessary permits from EPA are unlawful. Such an NPDES permit does not apply to discharge of pollutants from any vessels or floating craft, or subsurface injection wells for production purposes. Subsurface injection is subject to USGS regulations and operating orders.

The Clean Water Act of 1977, which amended the FWPCA, also applies to offshore operations and provides that lessees or operators may be held financially liable for damages due to oil spills. It provides for a liability up to $50 million for actual costs of oil removal and cleanup as well as replacement or restoration costs of natural resources damaged or destroyed by a spill.

EPA is also primarily responsible for facilities not related to transportation, such as terminal and storage facilities. Permits for any discharges would be issued by EPA or designated States according to established effluent guidelines. Provisions of the Clean Water Act also apply to onshore OCS-related facilities.

Interstate Commerce Commission. The Interstate Commerce Commission grants approval of the tariff rates for transportation of oil by common-carrier pipelines.

F. Issues Raised as a Result of Scoping

In accordance with Council of Environmental Quality (CEQ) Regulations (40 CFR 1501.7) the scope of the issues to be addressed was determined and the identification of significant issues related to the proposed action was identified. Issues and concerns for Proposed Sale No. 73 were submitted by Federal, State and local agencies and interested groups and individuals (see Section V. Consultation and Coordination), during the Request for Resource Information, the Call for Nominations and Comments and as a result of Scoping. Comments referred to issues previously submitted during the comment period and public hearings for Sales 53, and 68. Issues and concerns were also received from various counties and special interest groups concerning exploration, development and production located outside of the proposed sale area.

All issues and concerns received during the scoping process were summarized and as a result the following issues were identified:

Scoping Issues for Proposed Sale No. 73

I. Physical Environment
   A. General Issues
      1. Paucity of knowledge of water circulation offshore California.

         Data on circulation is employed in the determination of oil spill and pollutant discharge trajectories.
      2. Paucity of long-term data on offshore wind patterns. Data on wind patterns is employed in air quality and oil spill modeling.
      3. Adequacy of present oil spill containment and cleanup techniques in adverse sea conditions.
   B. Water Quality
      1. Degradation of water quality near platforms due to chronic discharges. (See Biological Environment, below)
      2. Degradation of water quality in the vicinity of oil spills. (See Biological Environment, below)
      3. Increase in water temperature from formation water discharges.
   C. Air Quality
      1. Degradation of air quality by increases in SO_x, NO_x and particulates caused by tankers, platforms and/or onshore OCS-related activity.
      2. Restriction of future industrial growth onshore due to strict pollution controls in areas exceeding air quality standards.
   D. Geohazards
      1. Failure of OCS oil and gas related structures due to potential geological hazards which result in release of hydrocarbons or loss of life.
      2. Locations of geologic hazards.

II. Biological Environment
   A. General Issues
      1. Acute effects of hydrocarbons (oil spills), drilling fluids, formation water, dispersants, and trace metals on marine organisms.
      2. Chronic (long-term) effects of hydrocarbons, drilling fluids, formation water, dispersants, and trace metals on reproduction, population density, and community structure of marine organisms.
      3. Bioamplification of trace metals and hydrocarbons within marine food webs.
      4. Transfer of contaminants from sediments and/or water column to marine organisms.
   B. Plankton
      1. Decreases in photosynthesis due to oil spills and/or increased turbidity.
      2. Reduction in planktonic eggs and larvae or marine organisms due to oil spills.
   C. Benthos
      1. Disruption of the physical environment by drill cuttings, platform placement, pipeline trenching, and anchoring.

2. Reduction in endemic species populations and changes in biogeographic transition zone communities.

D. Fish

Disruption of spawning areas by man-made structures.

E. Marine Mammals and Seabirds

1. Effects of noise from OCS oil and gas exploration and development on the behvior of marine mammals and seabirds; particularly, abandonment of rookeries and changes in migration routes.
2. Physical disruption of haulout areas and rookeries by pipeline construction and oil spill cleanup operations.

F. Threatened and Endangered Species

1. Same as E.1 above.
2. Same as E.2 above.

G. Special Areas (ASBSs, Estuaries, Marine Sanctuaries, National Parks, Unique Areas)

Physical disruption of estuaries and unique areas (rocky bottoms) caused by pipeline placement activities.

III. Social and Economic Environment

A. General Issues

1. Displacement of industry and change of character of less developed or rural areas.
2. Increased demand for public and private services and facilities exceeding existing or planned capacity.

B. Recreation and Tourism

1. Changes in recreation/tourism patterns and expenditures as a result of OCS development or accidents.
2. Degradation of the visual environment caused by platform placement offshore scenic and pristine areas.

C. Cultural Resources

1. Disturbance of archaeological and cultural sites by platform and/or pipeline placement.
2. Reduction of foodstuffs due to oil spills with consequences for subsistence gathering, religious practices and other uses.
3. Placement of large and relatively permanent sources of magnetic anomolies on the sea floor which may mask detection of shipwrecks.

D. Commercial Fisheries

1. Reduction in harvestable fish and invertebrate stocks. (See Biological Environment, above)
2. Interference with fishing activity by oil spills, man-made structures, debris, and anchor scars.
3. Loss of fishing gear (crab pots) due to entanglement with seismic boat cables.
4. Competition for berthing space and support services.
5. Regional economic ramification of adverse impacts on fisheries.

E. Transportation/Navigation

1. Increase in risk of vessel accidents.
2. Limitations to exploration and development of hydrocarbon resources imposed by the establishment of a Vessel Traffic Separation Scheme.

IV. Military Uses

Limitations on exploration and development imposed in military use areas.

All issues presented above have been identified as significant and are discussed in the EIS.

Physical Environment	Socioeconomic
General Issues	General Issues
Geologic Hazards	Demography
Water Quality	Coastal Economy
Ocean Dumping	Public Services and Facilities
Air Quality	Coastal Land Use
	Commercial Fisheries
	Sportfishing
Biological Environment	Recreation Tourism
	Visual Resources
General Issues	Cultural Resources
Intertidal Benthos	Ports and Harbors
Subtidal Benthos	Marine Traffic
Fish	Refineries
Marine Mammals	Offshore Structures
Seabirds	Military Uses
Endangered and Threatened Species	
Estuaries and Wetlands	
Areas of Special Concern	
Point Reyes/Marine Sanctuaries	

The following issues and concerns were evaluated during the review of comments submitted and were identified to be eliminated from detailed study. These issues and concerns were not considered significant or have been covered adequately by prior environmental review.

Plankton. Impacts on Plankton would be localized and short-term from hydrocarbon explorations and development activities, and from oil spills. Plankton were also previously discussed in the FEIS for OCS Lease Sale No. 53 (BLM, 1980). The impact analysis presented in Sale No. 53 EIS was based upon higher resource estimates, and therefore resulting in a higher number of oil spills, exploration and development operations, than the present analysis for Proposed Sale No. 73. Due to the lower resource estimates the impacts to Plankton are considered to be insignificant to the plankton community within the entire proposed sale area.

The possible greater impacts to planktonic larvae of certain fish and benthic invertebrates species are discussed in Sections IV.E.2.a, b, c, and g.

Terrestrial Biota. Any onshore facilities will have to comply with the Endangered Species Act, State and/or Federal as well as County and local restrictions. Impacts should be minimized through this consultation and coordination process. The level of acceptable impact will, however, depend on the restrictions of the responsible agency at any site.

G. Alternatives Considered as a Result of Scoping

In accordance with CEQ regulations (40 CFR 1502.14) reasonable alternatives to the proposed action were considered. Alternatives selected for preliminary

analysis were selected from Proposed Sale No. 73 scoping comments and from consideration of Sale No. 53 Alternative options.

Alternatives that were examined are described below.

1. Alternative to protect the sensitive Morro Bay biological areas. The primary intent of this Alternative was to reduce the liklihood of an oil spill entering the bay and ccontacting biological tidal flat and salt marsh habitats and the extensive feeding and breeding areas within the bay.

   This Alternative was selected for further analysis in the EIS (Alternative II - Modify the Sale to Protect Sensitive Biological Areas).

2. Alternative to reduce air quality Impacts to Coastal areas.

   This Alternative would establish a 6-mile buffer zone along the entire coast and adjacent to the proposed sale area, in order to reduce the impact of air pollution from offshore development on San Luis Obispo and Santa Barbara Counties.

   Preliminary analysis indicated that air pollution from offshore development would not be significantly reduced if a 6-mile buffer zone was established. Therefore this Alternative was not selected for further analysis in the EIS.

3. Alternative to defer leasing of tracts with potential geohazards.

   The intent of this Alternative would be to eliminate the likelihood of OCS oil and gas structure failure due to geological hazards. This would be accomplished through the elimination of lease areas that appear to have significant geological hazards.

   Existing regulation, OCS orders, and Notices to Lessees require that lessees conduct hazard surveys prior to commencing operations and if potentially hazardous conditions are identified, to demonstrate to MMS that their structures will be designed to safely conduct operations (see discussion in Section IV.A.10). Given these mitigating measures, it was not considered necessary to include a leasing deferred allternative for geohazards in this EIS.

ALTERNATIVES INCLUDING THE PROPOSED ACTION

II.

II. ALTERNATIVES INCLUDING THE PROPOSED ACTION

A. Analysis of Alternatives

1. Alternative I - The Proposed Action

a. Description of the Alternative: The proposed action (Alternative I) is offering for leasing those unleased tracts from Point Conception through Row N 816 UTM Grid System and within the boundaries of the Call for Nominations and Comments. The proposed action has been designated as Proposed OCS Oil and Gas Lease Sale No. 73 Central California, and is currently scheduled for October 1983. The tracts are located 3 to 66 miles offshore in water depths ranging from 50 to over 1,000 meters (see Figure II. A.1.a-1. Approximately 2 million acres (814,000 hectacres) or 360 tracts are located within the boundary of the proposed sale area. Situated within the proposed sale area are 55* leased tracts from OCS Sale No. 53, and 10 leased tracts from RS-2. In the unlikely event any of the previously leased tracts are relinquished prior to the sale, they will be considered for leasing.

b. Resource Estimates for the Proposed Action: Resource estimates for Proposed Sale No. 73 were calculated based upon an anlysis and review of the province petroleum geology, exploration history, volmetric-yield procedures, finding-rates studies, and structural analysis.

Conditional Mean Resource Estimates. The Conditional Mean Resource Estimate is an estimate of the total undiscovered recoverable oil and gas given that hydrocarbons are present within the proposed sale area. The Conditional Mean estimate of oil and gas to be recovered from this area is 970 million barrels of oil and 950 billion cubic feet of gas.

With the initiation of streamlining, resource estimates developed by the USGS Resource Appraisal Group (RAG) served as the basis for sale EIS. The RAG estimates of undiscovered recoverable resources differ from the method previously used in prior EIS' in several important respects.

1. The RAG resource estimates are not developed solely on the basis of identified prospects. The estimates include a "learning curve" and subjective assessments of future field types and size distributions. That is, in frontier areas RAG assumes knowledge gained from early exploration efforts wll be used to direct future exploration and development activities. The estimates include discoveries that will be made from all future rounds of exploration.

2. The RAG estimates include resources that may exist in traps and plays that are very difficult, if not impossible to identify with current technology or techonlogy which can reasonably be assumed to be developed in the near term.

*the decision on acceptance of 19 bids received from OCS Sale No. 53 is pending results of litigation.

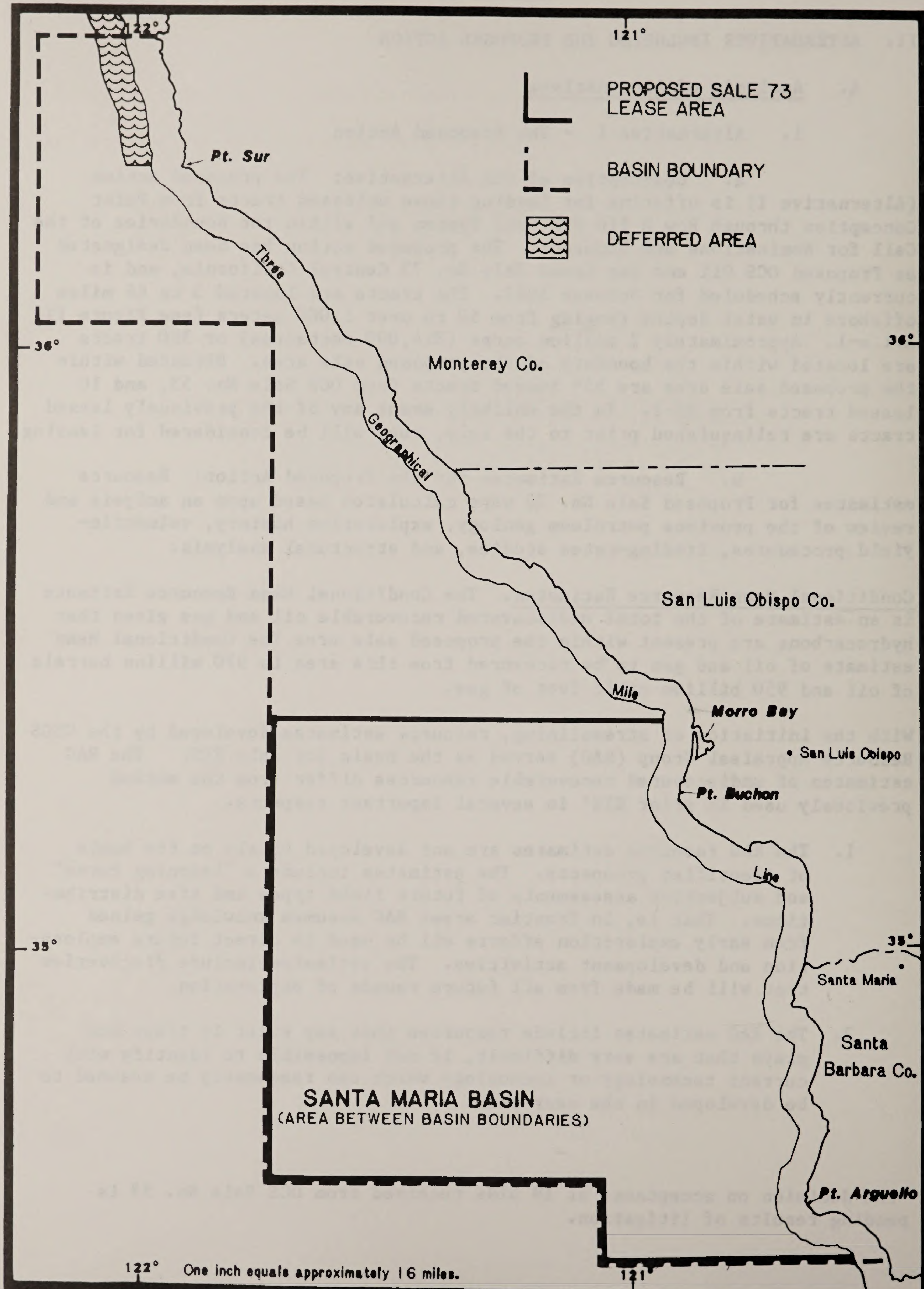


FIGURE II.A.1.a-1 PROPOSED SALE NO. 73 LEASE AREA

3. The RAG estimates are for the entire OCS area, including State waters and leased Federal OCS.

4. The RAG assessments of oil and nonassociated gas are done independently of one another. The assessments are not conditional upon the existence of hydrocarbons (oil and/or nonassociated gas) but on the existence of the particular fluid being assessed.

5. The RAG assessments are based upon areas termed "provinces." Various assumptions are necessary to aggregate the RAG province assessments for areas corresponding to planning areas.

Realizing the above differences exist between the previous and RAG methodologies, USGS modified the RAG assessments in the following manner.

1. The RAG province assessments of resources were aggregated assuming independence between the occurrence of oil and gas within and among provinces to an estimate for the planning area. This is possible only with the conditional mean resource level. The resultant estimate is the conditional mean estimate of undiscovered recoverable resources given commerical hydocarbons are present for the planning area.

2. Next, USGS on the basis of a percentage allocation removes the resources estimated to exist in the State waters.

3. The Minerals Management Service estimates of resources for existing leases are removed assuming statistical independence between leased and unleased tracts.

4. Removal of the resources estimated to exist within State lands and Federal leases is assumed to have no affect upon the probability of commerical hydrocarbons existing within the remaining area.

The end product of these modifications is the conditional mean estimate for undiscovered oil and gas resources given hydrocarbons are present for the unleased Federal OCS portion of the planning area. Due to the inclusion of unidentified prospects and a learning curve in the generation of these estimates, resources are included that cannot reasonably be assumed to be discovered as a result of the specific sale being addressed in the EIS, for this reason, it was decided to use this estimate for the "high case" scenario in the EIS. A "most likely" estimate of resources to be discovered and developed as a result of the sale was made taking into account the knowledge of the particular area's geology, economic considerations, exploration history, and potential learning curve in conjunction with finding rates in other OCS areas worldwide.

The Conditional Mean Resource Estimates and associated exploration, development, and production provide the basis for the analysis of a "high case" (Section IV.I). The "high case" discusses the expected impacts that would result if the total Conditional Mean resources were developed within the proposed sale

area. The "high case" analysis in conjunction with the development from other projects and proposals within the proposed sale area (Section IV.D) and development from existing leased tracts (Tables IV.C.3-1 and IV.D.4-1) provided the basis for the analysis of potential cumulative impacts (see Section IV.I).

Most Likely Resource Estimate. Most Likely Resource Estimate is a percentage of the Conditional Mean resource expected to be discovered and developed as a result of Proposed Sale No. 73 The percentage of the Conditional Mean resource which is expected to be developed as a result of this Sale is 291 million barrels of oil and 285 billion cubic feet of gas. The analysis of expected impacts for Alternative I and the subsequent alternatives are based upon the Most Likely Resource Estimate, associated exploration, development, and production, and Transportation Scenario No. 1 (Yamasaki, 1983). These expected impacts are described in detail in Section IV.E. The Most Likely Resource Estimate, associated exploration, development and production; and Transportation Scenario No. 1 in conjunction with the development from other projects and proposals within the proposed sale area (Section IV.D) and development from existing leased tracts (Tables IV.C.3-1 and IV.D-1) provide the basis for the analysis of potential cumulative impacts (see Section IV.E).

c. Development Timetables: The estimated development timetable for the discovery, development and production of the resources presented in Table II.A.1.c-1 is based upon the Most Likely and Mean Conditional Resource Estimates. Exploration for the Most Likely Resource Estimate is expected to begin in 1983 after the proposed lease sale and would continue over a 4-year period. Exploratory wells (wildcats) would be drilled to evaluate the potential of the suspected hydrocarbon-bearing formations. Exploration would continue until either an economically productive reservoir is discovered or a sufficient number of unsuccessful wells have been drilled to discourage further exploration. Various types of exploratory drilling rigs (jack-ups, drillships, submersible and semi-submersible rigs) would be used to drill an estimated 12 exploratory wells throughout the entire proposed sale area to evaluate the sale area's potential. Refer to Section IV.A.2 for a discussion of exploration assumptions.

If commercial quantities of hydrocarbons are located during the exploration period, the development phase for southern Santa Maria Basin is expected to occur from 1988 to 1990 with the installation of five platforms. Oil and gas production would begin in 1988 and end in 2007 (Figure II.A.1.c-1). As many as 155 development wells would be drilled. (Refer to Section IV.A.2 for a complete discussion of exploration and development assumptions.) The total number of wells, platforms, subsea completions, and miles of pipelines required to discover, develop, and produce the estimated amount of resources are also contained in Table II.A.1.c-1.

d. Projected Transportation and Markets: A summary of the potential transportation and markets developed for the proposed action is presented below. A detailed discussion of the Transportation Scenario No. 1 is presented in Yamasaki (1983) and in Section IV.A.3.

TABLE II.A.1.c-1

ESTIMATED DEVELOPMENT TIMETABLE OF OFFSHORE INFRASTRUCTURE
SOUTHERN SANTA MARIA BASIN

Year	Exploration well ML	Exploration well CM	Delineation well ML	Delineation well CM	Development well ML	Development well CM	Platform ML	Platform CM	Pipelines (miles) ML	Pipelines (miles) CM	Subsea Completion ML	Subsea Completion CM	Production Schedule Oil (MB) ML	Production Schedule Oil (MB) CM	Production Schedule Gas (MMCF) ML	Production Schedule Gas (MMCF) CM
1983	3	13														
1984	4	22	3	8												
1985	3	17	4	12												
1986	2	10	2	9												
1987		7		4		26		2		29				3,000		2,900
1988		4		3	14	76	2	5	46	40			2,300	14,300	2,200	14,000
1989		2		1	49	124	2	6	46	48			9,700	34,900	9,500	34,200
1990		2		1	64	144	1	5	22	40		2	18,500	59,100	18,100	57,900
1991		2		1	28	131		4		32			24,500	77,300	24,000	75,700
1992		1		1		115		4		32			29,200	87,900	28,500	86,200
1993						91		2		16			30,800	90,500	30,000	88,600
1994						55		1		8			27,800	85,600	27,100	83,800
1995						20							23,900	77,200	24,700	75,600
1996						1				8			20,600	65,700	20,200	64,300
1997						5		1*					17,700	58,600	17,400	57,400
1998						7							15,400	54,300	15,100	53,200
1999						5							13,100	46,200	12,900	45,200
2000													11,400	38,400	11,200	37,600
2001													9,900	34,200	9,700	33,500
2002													8,500	29,100	8,400	28,500
2003													7,300	24,600	7,200	24,100
2004													6,400	21,200	6,300	20,800
2005													5,400	18,300	5,300	17,900
2006													4,600	15,800	4,500	15,500
2007													4,000	12,500	4,000	12,200
2008														8,700		8,500
2009														5,400		5,300
2010														3,200		3,100
2011														2,400		2,400
2012														1,600		1,600
Total	12	80	9	40	155	800	5	30	114	253	0	2	291,100	970,000	285,000	950,000

* Ten Year Lease

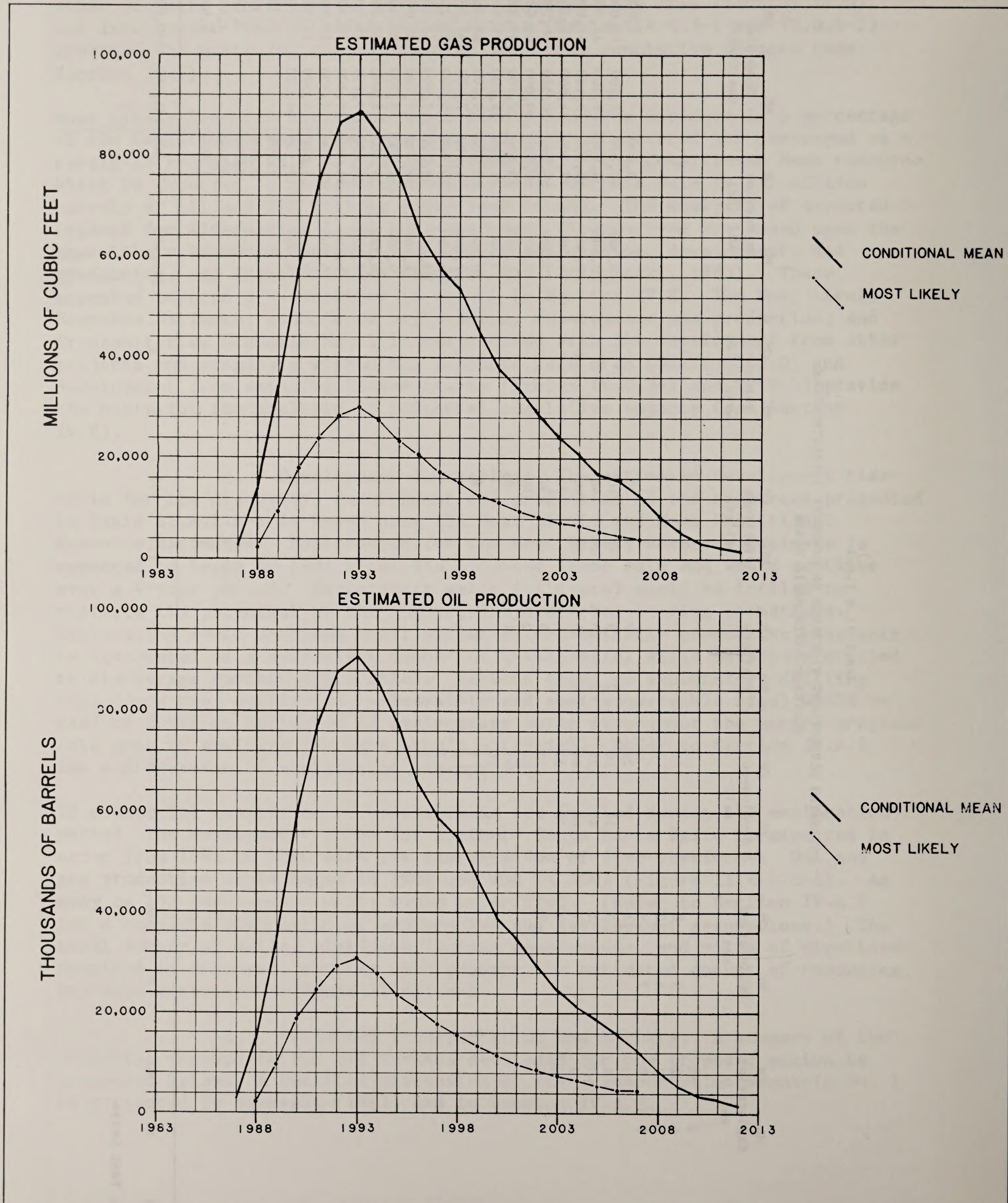


FIGURE II A.1c-1 YEARLY OIL AND GAS PRODUCTION

The projected transportation and markets are hypothetical scenarios based upon the development of the Most Likely Resource Estimates. Construction of subsea pipelines is assumed to begin with the installation of the platforms. A total of 114 miles of pipeline would be required to transport the oil and gas to shore. Oil will also be transported to shore by tankers (see Yamasaki, 1983). The number of proposed or assumed existing facilities to support offshore development is presented in Projected Transportation and Markets (refer to Section IV.A.3).

Hydrocarbon production from the northern portion of the proposed sale area would be transported to shore via subsea pipelines to treatment facilities assumed to be constructed at Nipomo Mesa (refer to Yamasaki, 1983). From this facility, oil would be transported by pipeline to Gaviota* and gas to an existing Southern California Gas Company pipeline.

Due to its proximity to the major new discoveries in the Santa Maria Basin, the Point Conception area is being considered as a processing site. Oil and gas production from the southern portion of the Santa Maria Basin would be transported to shore via a subsea pipeline to assumed existing processing and storage facilities at Point Conception (Yamasaki, 1983). From Point Conception, hydrocarbons would be transported via an assumed existing onshore pipeline to Gaviota.

A supply base, processing facilities, and an offshore marine terminal are presently under consideration at Gaviota (Petroleum Transportation Committee, 1982). Currently, Getty Oil Company operates a tank farm and a marine terminal at the site. Oil from the processing facility assumed to be constructed at Gaviota, would be transported by a pipeline under consideration (Petroleum Transportation Committee, 1982) to Los Angeles area refineries, and by tanker to the San Francisco and Gulf of Mexico refineries.

California refineries have the capacity to process all oil produced from the proposed action (Yamasaki, 1983). No new refineries will be required in California as a result of Proposed Sale No. 73. However, modifications to refineries could be required to process the expected heavy and sour Proposed Sale No. 73 crude oil.

California OCS oil and gas has been used for a variety of intermediate and final product uses. The particular end products depend upon the economic and corporate decisions that would evolve during the life of the proposal. Generally, oil and gas products of California are consumed within the State. Nevada and Arizona are also probable markets. In addition, numerous markets for refined oil from the Gulf of Mexico may exist in the eastern and southern states (see Section IV.A.3).

e. Mitigating Measures that are Part of the Proposed Action: The Secretary of the Interior has been designated by the Outer Continental Shelf Lands Act of 1953 (OCSLA) 43 USC 1331 et seq., as amended, to administer the activities which relate to the leasing, exploration, development, and

* Gaviota is one of the several Santa Barbara terminal sites presently under consideration by MMS. The selection of Gaviota as a terminal site for Proposed Sale N. 73 does not reflex MMS's decision on the possible site for the Santa Barbara terminal.

production of mineral resources of the OCS. In addition, various laws, Federal and State regulations, OCS Orders governing oil and gas lease operations, and Notices to Lessees are utilized by Federal agencies to mitigate environmental impacts or to establish operating standards. These laws, regulations, and orders are considered part of the proposed action (Section IV.B). The mitigating effect of these measures has been considered in the environmental impact analysis.

f. Potential Mitigating Measures: The following measures are proposed to reduce or eliminate adverse impacts identified in Section IV as a result of the proposed action and subsequent alternatives. A secretarial decision on these mitigating measures has not occurred; they are noted here as potential measures which could further mitigate impacts resulting from this Proposed Lease Sale No. 73. Some of these measures have been imposed by the Secretary in past lease sales. If any of these measures are adopted, they will appear in the Final Sale Notice. The impact analysis in this environmental impact statement does not assume that the following measures are in place.

i. Biological Stipulation: This stipulation provides protection for all biological resources. However, of particular concern are impacts to biological habitats associated with hard bottom areas (rocky areas). Impacts to rocky areas can result from exploration and development platforms, and drilling muds and cuttings.

Production platforms could alter the assemblages on hard bottoms for a radius of 100 meters. The alteration of the assemblage is caused by organisms falling from the platform structure and creating a different bottom surface and community.

The highest impacts from drilling muds and cutting on hard bottoms will be in those areas where the currents are weak. The highest concentration of muds and cuttings will primarily accumulate and settle on the drill site. Where the cuttings and muds accumulate most organisms will be buried, and the composition of the bottom will become altered within a radius of 10 to 100 meters around the platform or rig. Due to the alteration of the bottom substrate from the discharge of muds, cuttings, and associated impacts from the platform, recolonization will consist of species different from the original inhabitants. If platforms are not concentrated on rocky areas, the resulting impacts are expected to be moderate to high. Additionally, low impacts as far as 800 to 1000 meters are possible from drilling muds. (See Appendix A for definitions of impact levels.) If platforms are concentrated on hard bottom reefs the ecology of the entire rocky area could be altered resulting in a high impact.

All leases resulting from this lease sale will have the biological stipulation attached. It is planned to invoke the biolgical stipulation, as necessary, on tracts having rocky areas shown on Graphic No. 2 for the production phase of development.

This stipulation may be invoked for the production phase if it is discovered through hazard surveys or by other means that show the hard bottom structure

to be significant. The biological stipulation will be invoked for the exploration phase of development if hazard surveys show rocky areas that cannot be avoided by drilling 1000 meters from the outcrop.

Biological Stipulation

(a) If the Regional Supervisor Offshore Field Operations Division (RSOFOD) has reason to believe that biological populations or habitats exist and require protection, he shall give the lessee notice that the lessor is invoking the provisions of this stipulation and the lessee shall comply with the following requirements. Prior to any drilling activity or the construction or placement of any structure for exploration or development on lease areas including, but not limited to, well drilling and pipeline and platform placement, hereinafter referred to as "operation," the lessee shall conduct site specific surveys as approved by the RSOFOD and in accordance with prescribed biological survey requirements to determine the existence of any special biological resource including, but not limited to:

(1) Very unusual, rare, or uncommon ecosystems or ecotones

(2) A species of limited regional distribution that may be adversely affected by any lease operations

If the results of such surveys suggest the existence of a special biological resource that may be adversely affected by any lease operation, the lessee shall: 1) relocate the site of such operation so as not to adversely affect the resources identified; 2) establish to the satisfaction of the RSOFOD on the basis of the site specific survey, either that such operation will not have a significant adverse effect upon the resource identified or that a special biological resource does not exist. The RSOFOD will review all data submitted and determine, in writing, whether a special biological resource exists and whether it may be significantly affected by lessee's operations. The lessee may take no action until the RSOFOD has given lessee written directions on how to proceed.

(b) The lessee agrees that if any area of biological significance should be discovered during the conduct of any operations on the leased area, the lessee shall report immediately such findings to the RSOFOD and make every reasonable effort to preserve and protect the biological resource from damage until the RSOFOD has given the lessee directions with respect to its protection.

<u>Evaluation of Effectiveness</u>. The biological stipulation allows leasing activities to occur while providing protection to biological habitats. This stipulation was developed in consultation with the Fish and Wildlife Service, and requires that the lessees conduct environmental surveys when the RSOFOD believes them to be necessary.

Requiring site surveys provides for identification of specific areas which must be avoided prior to the installation of equipment and facilities. By imposing the biological stipulation, the unique organisms and habitats in these areas are adequately protected, while allowing the lessee to locate uninhabited areas for the placement of drilling structures which are compatible to the area. Therefore, the potential adverse impacts identified during the pre-lease process for this issue are believed to be adequately mitigated.

Through this stipulation the RSOFOD may require other mitigating measures for benthic communities that may include: 1) barging drilling fluids and muds away from the drill site, 2) shunting fluids and muds 3) avoidance a of the area of concern, and 4) monitoring during drilling operations to observe any changes

Barging would be an effective method of eliminating impacts from drilling fluids and muds. Although it is an effective method, a few problems are associated with barging. It is difficult and requires time to obtain dumping permits for the fluids and muds. Large volumes of fluids and muds from production platforms would be expensive and difficult to move. Barging of the muds would not prevent the buildup of a new community on the seafloor from organisms attached to the platform.

Shunting would be an effective method provided calculations are correct for the drilling fluids to avoid the benthic area of concern. Avoidance was mentioned above, and based upon present knowledge of drilling impacts, any impacts which might occur during drilling operation. If information from the monitoring show adverse impacts to the commnities present, other operating procedures, such as barging or shunting, can be initiated.

ii. Cultural Resource Stipulation

(To apply to all leases resulting from this lease sale.)

If the RSOFOD has reason to believe that a site, structure, or object of possible historic or prehistoric archeological significance (hereinafter referred to as a cultural resource) may exist in the lease area and gives the lessee written notice that the lessor is invoking the survey report provisions of this stipulation, the lessee shall, upon receipt of such notice, comply with the following requirements:

(1) Prior to any operation, the lessee shall conduct remote sensing surveys and/or prepare a report, as specified by the RSOFOD, to determine the potential existence of any cultural resource that may be affected by such operation. All data produced by such remote sensing surveys as well as other pertinent cultural and environmental data shall be examined by an archaeologist and geophysicist to determine if indications are present suggesting the existence of a cultural resource that may be adversely affected by any lease operation. A report of such surveys and assessments prepared by an archaeologist and geophysicist shall be submitted by the lessee to the RSOFOD for review.

(2) If such cultural resource indications are present, the lessee shall: (a) locate the site of such operation so as not to adversely affect the identified location; or (b) establish to the satisfaction of the RSOFOD on the basis of further archaeological investigation conducted by an archaeologist and geophysicist using such survey equipment and techniques as deemed necessary by the RSOFOD either that such operation will not adversely affect the location identified or that the potential cultural resource suggested by the occurrence of the indications does not exist.

(3) A report of this investigation prepared by the archeologist and geophysicist shall be submitted to the RSOFOD for review. Should the RSOFOD determine that the existence of a cultural resource which may be adversely affected by such operation is sufficiently established to warrant protection, the lessee shall take no action that may result in an adverse effect on such cultural resource until the RSOFOD has given directions as to its protection.

The lessee agrees that if any site, structure, or object of possible historic or prehistoric archeological significance should be discovered during the conduct of any drilling activity or the construction or placement of any structure for exploration or development on the lease, including, but not limited to, well drilling and pipeline and platform placement (hereinafter in this stipulation referred to as "operation"), he shall report immediately such findings to the RSOFOD and make every reasonable effort to protect the cultural resource from damage until the RSOFOD has given directions as to its protection.

Evaluation of Effectiveness. MMS has evaluated the potential for Cultural Resources in the Central California OCS area. Proposed Sale No. 73 encompasses approximately 2 million acres of seabed with a large portion of the area in very deep waters.

The vast area and depths involved make any archaeological search very difficult. For these reasons archaeological investigation on the Pacific OCS is confined to the most sensitive area, i.e., water less than or equal to 120 meters deep, or in areas of high potential density of shipwrecks.

The primary method of investigation is remote sensing (magnetometer, sidescan sonar, subbottom profiler). On leases which are considered to be in the more sensitive area, MMS may invoke the Cultural Resources Stipulation which requires a cultural resources survey be conducted in conjunction with the usual geohazards remote sensing survey. The methods by which this stipulation is implemented are specified by a periodically updated Notice to Lessees (NTL). NTL 77-3 is currently in effect.

Very few areas exist on the Central California OCS which are believed to have any potential for survivability of prehistoric sites (MMS, 1982a). Numerous shipwrecks are known to have occurred along the coast in historic times. All of these sites have a potential for impact from bottom disturbing activities. These activities could cause the site to suffer either irreversible and irretrievable loss of the information which could be

obtained or complete destruction. The methodologies used in the survey are estimated to be 90 percent effective (MMS, 1982b) in detecting all the cultural resources in the area.

Although a very low impact is anticipated to cultural resources in the sale area, a high impact could occur on a case by case basis for individual sites. Utilizing the survey, these potential impacts to individual sites will be greatly reduced or eliminated.

Based upon water depth and known cultural resource location data, the following tracts are expected to be recommended for invocation of the Cultural Resources Stipulation:
15, 16, 31, 94, 112, 113, 114, 174, 193, 194, 213, 233, 315, 349, 358, 359, 360

Tracts 254, 274, 295, 335, and 350 have been surveyed in the past and the stipulation will be invoked on the these tracts if new information indicates a potential for previously undiscovered cultural resource.

If potential cultural resources are identified as a result of the remote sensing survey, MMS will require the operator: 1) avoid the object(s), or 2) identify the object(s) through additional investigation (e.g., remote camera, diving archaeologists) as something other than a cultural resource. Based on past experience with cultural resources in this area, MMS expects in most cases the lessee will choose the former alternative, avoidance. Protection of cultural resources by avoidance is considered an appropriate form of mitigation. In addition, the lessee or agent, during any activities on the leasehold, is required to report any findings to the RSOFOD in the event any site or object of historic or archaeologic significance should be discovered. The lessee is also required to make every reasonable effort to preserve and protect such site or object from damage until the RSOFOD makes a determination on its preservation. Through the imposition of this stipulation and compliance with applicable Federal and State laws regarding cultural resources, it is believed potential impacts to cultural resources are adequately mitigated.

iii. Military Stipulation No. 1

(This stipulation will apply to tracts determined through consultation with the Department of Defense which conflicts with military operating areas.)

(a) The lessee agrees that prior to operating or causing to be operated on its behalf boat or aircraft traffic into individual, designated warning areas, the lessee shall coordinate and comply with instructions from the Commander, Western Space and Missile Center (WSMC), the Commander, Pacific Missile Test Center (PMTC), and Commander, Fleet Area Control and Surveillance Facility (FACSFAC), or other appropriate military agency. Such coordination and instruction will provide for positive control of boats and aircraft operating in warning areas at all times.

(b) The lessee, recognizing that mineral exploration and exploitation and recovery operations of the leased areas of submerged

lands can impede tactical military operations, hereby recognizes and agrees that the United States reserves and has the right to temporarily suspend operations of the lessee under this lease in the interests of national security requirements. Such temporary suspension of operations, including the evacuation of personnel, and appropriate sheltering of personnel not evacuated (an appropriate shelter shall mean the protection of all lessee personnel for the entire duration of any Department of Defense activity from flying or falling objects or substances), will come into effect upon the order of the RSOFOD after consultation with the Commander, Western Space and Missile Center (WSMC), the Commander, Pacific Missile Test Center (PMTC), and the Commander, Fleet Area Control and Surveillance Facility (FACSFAC), or other appropriate military agency, or higher authority, when national security interests necessitate such action. It is understood that any temporary suspension of operations for national security may not exceed 72 hours; however, any such suspension may be extended by order of the RSOFOD. During such periods equipment may remain in place.

(c) The lessee agrees to control his own electromagnetic emissions and those of his agents, employees, invitees, independent contractors or subcontractors emanating from individual, designated defense warning areas in accordance with requirements specified by the Commander, Western Space and Missile Center (WSMC), the Commander, Pacific Missile Test Center (PMTC), and the Commander, Fleet Area Control Surveillance Facility (FACSFAC), or other appropriate military agency, to the degree necessary to prevent damage to, or unacceptable interference with, Department of Defense flight, testing or operations activities conducted within individual, designated warning areas. Necessary monitoring, control, and coordination with the lessee, his agents, employees, invitees, independent contractors or subcontractors, will be affected by the Commander of the appropriate onshore military installation conducting operations in the particular warning area: provided, however, that control of such electromagnetic emissions shall permit at least one continuous channel of communication between a lessee, its agents, employees, invitees, independent contractors or subcontractors, and onshore facilities.

iv. Military Stipulation No. 2.

This stipulation indemnifies and saves harmless the United States against all claims for loss, damage, or injury sustained by the lessee.

Whether or not compensation for such damage or injury might be due under a theory of strict or absolute liability or otherwise, the lessee assumes all risks of damage or injury to persons or property, which occurs in, on, or above the Outer Continental Shelf, to any person or persons or to any property of any person or persons who are agents, employees or invitees of the lessee, its agents, independent contractors or subcontractors doing

business with the lessee in connection with any activities being performed by the lessee in, on, or above the Outer Continental Shelf, if such injury or damage to such person or property occurs by reason of the activities of any agency of the U.S. Government, its contractors, or subcontractors, or any of their officers, agents or employees, being conducted as a part of, or in connection with, the programs and activities of the Western Space and Missile Center (WSMC), the Pacific Missile Test Center (PMTC), or other appropriate military agency.

Notwithstanding any limitations of the lessee's liability in Section 14 of the lease, the lessee assumes the risk whether such injury or damage is caused in whole or in part by any act or omission, regardless of negligence or fault, of the United States, its contractors or subcontractors, or any of their officers, agents, or employees. The lessee further agrees to indemnify and save harmless the United States against all claims for loss, damage, or injury sustained by the lessee, and to indemnify and save harmless the United States against all claims for loss, damage, or injury sustained by agents, employees, or invitees of the lessee, its agents or any independent contractors or subcontractors doing business with the lessee in connection with the programs and activities of the aforementioned military installations and agencies, whether the same be caused in whole or in part by the negligence or fault of the United States, its contractors, or subcontractors, or any of their officers, agents, or employees and whether such claims might be sustained under theories of strict or absolute liability or otherwise.

Evaluation of Effectiveness. The two military stipulations were developed in consultation with the Department of Defense. These stipulations relating to electromagnetic interference, shelter/evacuation, and holding harmless may be included in Proposed Sale No. 73 leases as they have been in previous OCS sales. Although these stipulations do not eliminate all impacts to the military, they are considered to adequately mitigate any potential Department of Defense conflicts in tracts to which they are applied. With the selection of the military stipulation the impacts to military activities would be reduced from high to low. Even though space-use conflicts from structure placement and vessel traffic would still exist, it would be reduced through the machanism and procedure for coordination now being officially mandated.

v. Transportation of Hydrocarbon Products Stipulation

(To apply to all leases resulting from this lease sale.)

(a) Pipelines will be required: (1) if pipeline rights-of-way can be determined and obtained; (2) if laying of such pipelines is technologically feasible and environmentally preferable; and (3) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple use conflicts. The lessor specifically reserves the right to require that any pipeline used for transporting production to shore be placed in certain designated management areas. In selecting the means of transportation, consideration will be

given to any recommendation of the intergovernmental planning program for assessment and management of transportation of Outer Continental Shelf oil and gas with the participation of Federal, State, and local governments and the industry.

(b) Following the development of sufficient pipeline capacity, no crude oil production will be transported by surface vessel from offshore production sites, except in the case of emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the RSOFOD.

(c) Where the three criteria set forth in the first sentence of this stipulation are not met and surface transportation must be employed, all vessels used for carrying hydrocarbons to shore from the leased area will conform with all standards established for such vessels, pursuant to the Port and Tanker Safety Act of 1978 (PL 95-474).

Evaluation of Effectiveness. The intent of this measure is to transport hydrocarbons by the safest and environmentally preferable method. This stipulation requires, when feasible, pipelines to be used instead of tankers to transport oil. This would reduce the number of oil spills expected from the proposal since transportation of oil by pipeline results in fewer oil spills than by tankering. Oil spills resulting from tankering usually occur during unloading and loading, adverse sea conditions and as a result of collisions. The reduction in the number of oil spills is expected to significantly reduce the probability that an oil spill will occur and contact sensitive areas.

vi. Wells and Pipeline Stipulation

(To apply to all leases resulting from this lease sale.)

(a) Wells. Subsea wellheads and temporary abandonments, or suspended operations that leave protrusions above the sea floor, shall be protected, if feasible, in such a manner as to allow commercial trawl gear to pass over the structure without snagging or otherwise damaging the structure or the fishing gear. Latitude and longitude coordinates of these structures, along with water depths, shall be submitted to the RSOFOD. The coordinates of such structures will be determined by the lessee utilizing state-of-the-art navigation systems with the accuracy of at least ±50 feet (15.25 meters) at 200 miles (322 kilometers).

(b) Pipelines. All pipelines, unless buried, including gathering lines, shall have a smooth-surface design. In the event that an irregular pipe surface is unavoidable due to the need of valves, anodes or other structures, those irregular surfaces shall be protected in such a manner as to allow trawl gear to pass over the object without snagging or otherwise damaging the structure or the fishing gear.

Evaluation of Effectiveness. Existing MMS regulations require that subsea objects be marked by aids to navigation as directed by the U.S. Coast Guard unless: 1) they are submerged in water depths greater than 305 m (1,000 feet), 2) they weigh 18 kilograms (40 pounds) or less and are of such shape or configuration that they are unlikely to snag or damage fishing devices, or 3) they are less than 46 m (150 feet) from fixed structures on which approved aids to navigation are maintained. Therefore, subsea wellheads (wells connected by pipelines to a platform or that are part of a subsea completion system), temporary abandonments (temporarily abandoned subsea wellheads) and similar subsea objects usually are required to be marked by a suitable aid to navigation. Although this helps fishermen to avoid these structures, there still is a significant potential for fishing nets to become entangled on these structures, particularly if these structures are placed in important trawl grounds. This potential for conflict could cause economic losses to the commercial fishing industry through net damage and loss or through preclusion of fishing in areas. This stipulation would require that subsea wellheads and temporary abandonments be protected, if feasible, so commercial trawl gear can pass over these structures. Thus, fishermen would not be precluded from fishing in areas where these wells are located and would not sustain net damage and loss. The cumulative impact of these structures is expected to result in significant economic losses to fishermen. Adoption of this stipulation would nearly eliminate economic losses to fishermen caused by these structures.

vii. Fisheries Training Program Stipulation

(To apply to all leases resulting from this lease sale.)

The lessee shall include in his exploration and development plans, submitted under 30 CFR 250.30, a proposed fisheries training program for review and approval by the RSOFOD. The training program shall be for all personnel involved in exploration, development and production operations, and for platform and shorebased supervisors. The purpose of the training program shall be to familiarize persons working on the project of the value of the commercial fishing industry, the methods of offshore fishing operations, the potential conflicts between fishing operations and offshore oil and gas activities, the locations of marine mammal and bird rookery sites in the area, the seasonal abundance and sensitivities of these animals to disturbance, and the federal laws that have been established to protect endangered and threatened species from harrassment and injury. The program shall be formulated and implemented by qualified instructors.

Evaluation of Effectiveness. Commercial fisheries, marine mammals, and birds are expected to sustain losses from the proposal. These losses will be from oil spills, manmade structures, vessels and noise. This training program will explain the value of these resources and what oil and gas personnel can do to reduce impacts. A reduction in impacts to commercial fisheries, marine mammals, and birds is expected from adoption of this stipulation.

g. Summary of Impacts: The information provided below is a summary of the impacts for Alternative I (the Proposed Action). The analysis of expected impacts were based upon the Most Likely Resource Estimates, associated Exploration, Development and Production of the resources, and Transportation Scenario No. 1 (Yamasaki, 1983). All applicable laws, regulations and Pacific OCS orders (see Section I.D. and E and Section IV.B) were considered in place during the analysis. A detailed discussion of the expected impacts is presented in Section IV.E. In the analysis, oil spills were assumed expected when the Oil Spill Analysis Model predicted a 25 percent probability or greater of one or more spills occurring and contacting land segments or targetts. The actual environmental risk may prove significantly higher or lower due to the extremely difficult nature or predicting oil spills and their movements, and the many parameters called for by the model. Therefore, potential impacts as a result of an oil spill are also presented in Section IV.E. Definitions of impact levels are further discussed ad tabulated in Appendix A.

i. Physical Environment:

Water Quality. Water quality in the immediate vicinity of oil exploration and development activities could be degraded. The degree of impact (degradation) to water quality would be very low to low (see definitions of impact levels in Appendix A) from routine discharges. Impacts to water quality would be moderate in the proposed sale area from the one expected oil spill. The short term effects of OCS activities in the marine environments, except immediately around platforms, should not result in any greater than very low levels of change in water quality parameters (trace metals, hydrocarbons, salinity, temperature, turbidity, pH, etc.).

Ocean Dumping. The impacts to dump sites within the proposed sale area would be very low (boundary lines might overlap but operations will not disturb any existing dump sites, or operations will have no conflicts with use of area as a dump site).

Air Quality. Moderate air quality impacts were predicted (Form and Substance, 1983) for coastal regions adjacent to the proposed sale area (significant increase in pollutant concentrations within a nonattainment area expected to occur about 2 or 3 days per year). It is likely, therefore, that OCS facilities associated with Proposed Sale No. 73 would be required under Department of the Interior air quality regulations to apply emission controls. Application of emission controls would reduce the predicted impacts to low. Significant increases in short-term NO_2 concentrations were also predicted, but concentrations would most likely be below State ambient air quality standards.

ii. Biological Environment

Intertidal Benthos. Impacts to Central California intertidal areas would not be expected to occur due to the proposed action.

Subtidal Benthos. Impacts to the subtidal benthos would be low (an interference with ecological relationships lasting less than a year) from oil and gas production activities due to the proposed action. However, high (a significant interference with ecological relationships lasting at least two

Public Services and Facilities. The impacts to public services and facilities would be moderate, that is, short-term stress of local systems that may be accommodated through time and with small use adjustments. Expected impacts to water supply systems would be high for the proposed sale area. Impacts on wastewater treatment facilities would be low for the proposed sale area, some localized stress. Impacts to transportation systems (road, air, railroad) would be low in the southern portion of the Santa Maria Basin (minor short-term stress on local systems) and very low elsewhere. Impacts to the electrical power supply would be very low, or insignificant.

Coastal Land Use. Impacts to land use in the the Santa Maria Basin area would be low. Impacts to housing availability would be very low (less than 1 percent increase in the need for housing for OCS related population growth, when compared to overall expected population growth.

Commercial Fisheries. Impacts to the commercial fishing industry as a whole would be low (less than a 10 percent economic loss to the industry). Trawl fishermen in the proposed sale area would sustain moderate economic losses for at least 3 years due to pipeline laying activities, and some fishermen would sustain small economic losses due to navigation hazards or gear loss, during years of peak activity but no effect on secondary employment (fish processing plants, etc.) would be expected.

Sportfishing. The impact to sportfishing would be low (a small economic loss to the industry, most fishing continues).

Recreation. The proposed development is xpected to have low impacts (no closure of water oriented recreational facilities; most boach and water use still possible; or lss than a 5 percent loss to the recreation industry) on recreation.

Tourism. The proposed development is expected to haave very low impacts on tourism.

Visual Resources. The proposed development would have a low impact (Minor degradation in visual quality; most people accept the change; no reduction in recreational use or property values) to visual resources. The exact amount of degradation would depend upon the location and type of the OCS structure.

Cultural Resources. Low impacts (remote possibility of presence and disturbance of cultural resources) to cultural resources in Central California would be expected for the proposal. Localized moderate impacts (significant possibility of both presence and disturbance of cultural resources) could occur at Point Conception from Offshore Structures. The impact to submerged resources is difficult to determine because of the lack of data on submerged resources in Central California.

Ports and Harbors. High impacts to Port San Luis would be expected, primarily due to competition for vessel berth space and support facilities. This competition would lead to the need for additional docks, berths, and facilities. The additional vessel traffic resulting from the proposal would only have a very low impact at the Port of San Francisco.

long-term years) impacts would be possible on rocky outcrops within the proposed sale area.

Fish Resources. The proposal would result in very low impacts to fish resources (sublethal and lethal changes insignificant).

Marine Mammals. Impacts to the northern fur seal are expected to be high (25 percent mortality of the California population) if a spill occurs during pupping or breeding season. Impacts to all other species - seals, sea lions, whales, porpoise, dolphins, and sea otters are expected to be very low.

Seabirds. Impacts to the California seabird population are expected to be moderate (2-15 percent mortality of the California population of a species) due to an oil spill expected to contact the buffer zone around the northern Channel Islands.

Endangered and Threatened Species. Impacts to all Endangered Species from oil spills would be very low (less than 2 percent mortality) since no large spills would be expected to occur and contact habitat utilized by these species. Noise and disruption are also expected to have very low impacts on Endangered Species.

Estuaries and Wetlands. Impacts to Central California estuaries and wetlands are not expected to occur due to the proposed action.

Areas of Special Concern. Impacts to the areas of special concern in Central California are not expected to occur due to the proposed action.

Point Reyes/Marine Sanctuaries. Impacts to the Point. Reyes/ Farallon Islands National Marine Sanctuary and Point Reyes Wilderness Area/ National Seashore are not expected to occur due to the proposed action.

The Channel Islands National Marine Sanctuary is expected to experience impacts from an oil spill. Northern fur seals are expected to experience high impacts if a spill occurs during pupping or breeding season.

iii. Socioeconomic Environment

Coastal Economy. OCS activity from Proposed Sale No. 73 would have a insignificant effect on employment and earnings in the region. Total employment impacts from Alternative I are expected to be very low (a change in employment of less than percent). Change in earnings for the total sale area would be low (a change in employment of 1 to 3 percent).

Demography. The change in population for each subregion is expected to be less than one percent of the population base in the peak year (1990). The permanent increase in population (approximately 67,000) as a result of this alternative is expected to be 0.06 percent of the 1990 population. Increases in population of the magnitude expected are considered to be insignificant.

Marine Traffic. Low impacts to marine traffic in the Central California and Santa Barbara Channal area would occur as a result of additional vessel traffic and offshore structures associated with Proposed Sale No. 73. Low impacts to this resource category means that vessel conflicts (i.e., collisions, rerouting) occur, but they are minor in character and infrequent. The estimated number of vessel accidents during exploration, development, and production activities should be small if current U.S. Coast Guard policy is followed. Presently, this policy does not permit surface hydrocarbon operations (drilling) within Precautionary Areas, safety fairways or vessel traffic lanes.

Refineries. California refineries have the capacity and would process all Proposed Sale No. 73 crude oil that is shipped or piped to them. Therefore, there would be no need for new refineries to be constructed. However, it is expected that most of the Proposed Sale No. 73 crude oil would be heavy and high in sulphur content. This quality of crude would contribute to the need for expensive modifications (i.e., retrofitting) to the refining process. The cost of these modifications is estimated to be from $10 million to $800 million per refinery (1982 dollars). This is considered to be a low impact (i.e., Proposed Sale No. 73 crude oil would be expected to represent a partial contribution to the requirement for expensive modifications to the refinery process) to individual refineries.

Offshore Structures. Impacts to offshore structures would be confined to the Santa Barbara Channel since the only existing platforms are in this area. Impacts will probably be due to small vessels contacting the platforms. These impacts would be low (affected structures could be repaired, with little, if any, replacement; downtime would be one or two days).

Military Uses. Without the Military Stipulation, the overall impacts expected to military operations would be high (significant alteration or reductions to military operations would be required) as substantial overlap of military operating areas and the Proposed Sale No. 73 area exists (87 percent in the southern portion of the proposed sale area). However, these impacts would be adequately mitigated with the invocation of the standard Military Stipulation.

2. Alternative II - Modify the Sale to Protect Sensitive Biological Areas

a. Description of the Alternative: Alternative II would modify the sale area by eliminating 3 tracts and those portions of 4 tracts which coincide with a 10-mile zone centered on Morro Bay (see Figure II.A.2-1). This area represents approximately 23,000 acres. The total proposed sale area would be reduced by less than 1 percent by this alternative. Resource estimates can not be made on such a small area without disclosing proprietary information. For the purpose of environmental analysis, we have assumed that deletion of these tracts would not significantly change the development and transportation scenarios; and the expected number of spills from the proposal.

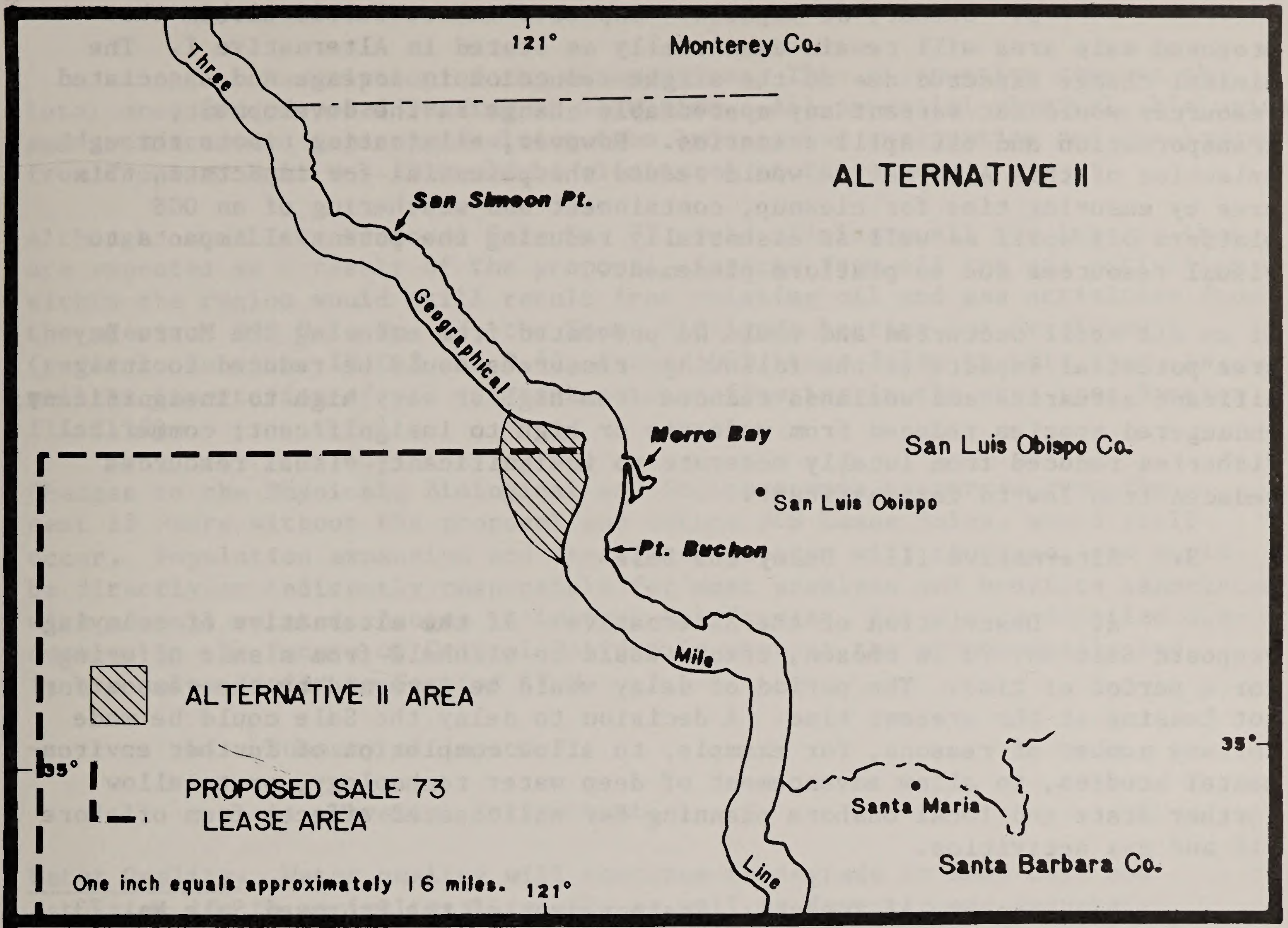


FIGURE II.A.2-1 ALTERNATIVE II - MODIFY THE SALE TO PROTECT SENSITIVE BIOLOGICAL AREAS

b. Summary of Impacts: Expected impact levels within the proposed sale area will remain essentially as stated in Alternative I. The minimal change expected due to the slight reduction in acreage and associated resources would not warrant any appreciable change in the development, transportation and oil spill scenarios. However, eliminating tracts through selection of this Alternative would reduce the potential for impacts in this area by ensuring time for cleanup, containment and weathering of an OCS platform oil spill as well as essentially reducing the potential impacts to visual resources due to platform placement.

If an oil spill occcurred and could be prevented from entering the Morro Bay area potential impacts to the following resources would be reduced to insignificant estuaries and wetlands reduced from high or very high to insignificant; endangered species reduced from moderate or high to insignificant; commerical fisheries reduced from locally moderate to insignificant; visual resources reduced from low to insignificant.

3. Alternative III - Delay the Sale

a. Description of the Alternative: If the alternative of delaying Proposed Sale No. 73 is chosen, tracts would be withheld from a sale offering for a period of time. The period of delay would be governed by the reason for not leasing at the present time. A decision to delay the Sale could be made for any number of reasons, for example, to allow completion of further environmental studies, to allow advancement of deep water technology, or to allow further State and local onshore planning for anticipated effects from offshore oil and gas activities.

b. Summary of Impacts: Postponement of the Proposed Sale No. 73 would result in delay in the exploration, development, and production of oil and gas resources. Any economic or national security benefits which could be attributed to the domestic production of hydrocarbons in these amounts would be postponed.

A delay of the Sale may not change any of the impacts assumed to occur as a result of Proposed Sale No. 73. It would most likely postpone their occurrence. However, improvements may occur in technologies for oil spill prevention and recovery, deepwater drilling and production techniques, or for exploration and production in hostile environments which may lessen the risk of some adverse impacts. Also, new information on oil and gas resources may become available from drilling on adjacent existing leases and the economic feasibility of developing an area will probably improve.

Another reason for delaying Proposed Sale No. 73 could be to obtain additional information within the proposed sale area. Additional information from on going or future studies will enhance the knowledge of the environment and effects of OCS activities. However, without a delay of the Sale, the studies information will, become available for use in evaluating exploration strategies and in developing production plans. In addition, as existing and future oil and gas development (Federal and State) occurs within the area. Impacts from these activities would provide additional information for cumulative analysis.

4. Alternative IV - No Sale

a. Description of the Alternative: This alternative removes the total area for proposed leasing at this time. All potential physical, biological, and socioeconomic impacts resulting from hydrocarbon exploration and development from Proposed Sale No. 73 would be eliminated at this time.

Although cancelling Proposed Sale No. 73 would eliminate all the impacts that are expected as a result of the proposal, impacts from oil and gas activities within the region would still result from existing oil and gas activities from the previous OCS Sale No. 53, the State Tidelands leasing and development (refer to Sections IV.C.3 and D.4), future OCS Lease Sales in this area, as well as importation of oil via tankers to refineries in the area (see Section III.C.13).

Changes to the Physical, Biological and Socioeconomic resources over the next 25 years without the proposal and future OCS Lease Sales, would still occur. Population expansion and associated impacts will continue, and would be directly or indirectly responsible for most problems and benefits associated with non-oil related changes in Central California. For a more detailed discussion on the future of Central California without the proposed sale and future sales, refer to Section IV.H.

b. Summary of Impacts

i. Physical Environment

Water Quality. Water quality will continue to degrade in many bays and estuaries due to agricultural runoff, as well as domestic and industrial pollution. OCS waters will continue to receive trace metals (e.g., lead) due to the combustion of fossil fuels and subsequent aerial washout near major populations centers.

Dump Sites. New dump sites will be designated as their need arises, and positioning of these sites will be in areas of least potential environmental impact. Deterioration of the water quality will occur temporarily and locally at each of the dump sites; however, overall there will be minor changes. The impact from the dump sites are expected to remain at present levels.

Air Quality. Many coastal areas would continue to experience episodes of ozone concentrations exceeding State or Federal Standards. However, with increasingly stringent pollution control strategies, ozone levels should gradually decline in the future. Overall air quality should remain at a constant level or perhaps experience a slight decrease.

ii. Biological Environment

Intertidal Benthos. With the expected population expansion and development along the coast of Central California, some corresponding impact to the intertidal environment is expected. Although the rate of degradation will be decreased due to State and local commitments and legal mandates, the amount is non-quantifiable and unpredictable except in general terms.

Subtidal Benthos. The principal non-oil effects to the subtidal benthos will come from pollution and waste disposal. Most of these impacts will be localized near cities, but the magnitudes of the impacts are difficult to predict.

Fish. Fish populations will experience large to very large decreases due to stresses caused by fishing pressure, sewage disposal, natural oil seeps, existing and future oil and gas development (Federal and State) and oil tanker and other vessel traffic.

Marine Mammals. Without the proposal, marine mammals will suffer impacts from sewage, increased tanker and recreational traffic, existing oil and gas leases (Federal and State), expanding population centers along the coast, changing climatic conditions and other natural causes. However, most whales and pinniped numbers are increasing annually and should continue to do so. The status of the Southern Sea Otter is questionable. Until it is determined whether the population is still increasing or is decreasing, predictions are impossible.

Seabirds. Without the proposal, seabirds will suffer impacts from several sources over the next 25 years. Sewage, increased tanker and recreational traffic, existing leases (Federal and State), expanding population centers along the coast and changing climate conditions may reduce seabird distribution and populations. However, with increased conservation efforts it is possible many of these effects can be reduced.

If pollution levels remain constant or increase, some species may suffer low level impacts from several sources and a general degradation of health is possible. Overall, the impacts are expected to be low to moderate; that is, some individuals may die but most species are expected to maintain viable populations.

Endangered and Threatened Species. Sewage disposal, increased tanker and recreational traffic, expanding population centers along the coast, changing climatic conditions or other natural changes, and existing leases (Federal and State) may cause changed in species abundance and distributions. Some species such as brown pelicans, least terns, peregrin falcons and bald eagles seem to be recovering. Other species such as the rails are secretive animals and little of their habitat remains. The status of some populations of the otter is also in question and oil spills from foreign tankering are always a serious threat. Overall, it is expected some species will increase in numbers and distribution. Others face extinction over the next 25 years.

Estuaries and Wetlands. With the predicted population expansion and development near wetlands, some corresponding degradation to these areas is expected. Although the rate of degradation will be decreased due to State and local commitments and legal mandates, the amount is non-quantifiable and unpredictable except in general terms.

Areas of Special Concern. The above discussion of intertidal benthos can be applied here since most of the Sensitive Biological Areas are intertidal areas. Whether these protected areas will be degraded or upgraded in the future will primarily depend upon the quantity and quality of domestic pollution, enforcement and prevention of intertidal collecting, and reduction in the amount of human traffic allowed on the sensitive areas.

Pt. Reyes/Marine Sanctuaries. If the No Sale Alternative is chosen, parts of the Point Reyes/Farallon Island Marine Sanctuary will be affected from pollution contained in the outflow of San Francisco Bay. Both the Channel Islands National Marine Sanctuary and Point Reyes National Seashore could be impacted by import oil tanker accidents.

iii. Socioeconomic Environment

Coastal Economy. Without Proposed Sale No. 73, the study area is expected to experience a significant increase in the labor force and general economic activity. The labor force in the study area is projected to increase by 60.08 percent during the project period. However, the average increase in the labor force would be 1.18 percent per year of the base.

Demography. Selection of this alternative will result in the removal of all impacts associated with Alternative I. However, the study area is expected to have a large increase in population between 1980 and 2020. Population is expected to increase by 78.3 percent or an annual increase of 1.46 percent. The additional population is expected to result in an increased housing demand, reduced household size, and reduced rate of home ownership.

Public Services and Facilities. Increases in population of Central California, as projected by the State of California, will stress public services and facilities.

Coastal Land Use. Projected population growth using State of California figures will create a demand for intensive land use. Commercial and industrial growth will create demands for rezoning of existing land use. The demand and need for affordable housing will continue. Overall all types of housing will continue to be in demand from the increasing population. Local jurisdiction will have to deal with growth induced demands through Local Coastal Programs, Port Master Plans, and City and County General Plans.

Commercial Fisheries. Without the proposal, California commercial fishermen are expected to sustain economic losses due to natural fluctuations in fish and shellfish populations, competition with other fishermen, changes in market conditions, restrictions on fish harvests.

Sportfishing. Public participation in sportfishing is expected to increase slightly without the proposal. Limited transportation to fishing sites is the major restraint on continued growth. Sportfishing will be sufjected to natural fluctuations in fish and shellfish populations.

Recreation. Recreation will continue to grow in the absence of Proposed Sale No. 73, but will continue to risk impact from sources such as municipal sewage, regulated access, and rising costs.

Tourism. Tourism will continue to increase, even though gas shortages and economic recessions are possible during the same period.

Visual Resources. Visual resources will essentially remain at the present level with minor decreases due to residential development along the backshore and development of recreational facilities along the shore.

Cultural Resources. Due to population expansion more terrestrial and marine sites will be discovered. This will be accompanied by increased looting. However, a greater number of sites will be protected due to increased interest in conservation of sites, particularly on land.

Ports and Harbors. Import oil will increase potential conflicts at the Port of San Francisco. Oil development in Santa Maria Basin from OCS Sale No. 53 will increase the use of the Port of San Luis.

Marine Traffic. Commercial vessels using the Traffic Separation Scheme through the Santa Barbara Channel would increase from about 19 to 38 percent between 1980 and 2000. A similar increase could be anticipated for the San Francisco area. There will be an increase in foreign and Alaskan tankers carrying crude oil to the San Francisco and Los Angeles area refineries.

Refineries. There will be an increase in the foreign and Alaskan tankers crude oil to the San Francisco area refineries. Several refineries are presention performing modification to accommodate California crude. Without the proposal, many of the refineries will lose much of their investment and benefits from the modifications.

Offshore Structures. Present structures will remain and planned structures in the Santa Maria Basin from past sales and future State of California sales will be constructed.

Military. As coastal populations and vessel traffic continue to increase, conflicts with military activities will also increase. There will be less area available for exclusive military and joint military/civilian use. As a result, the military will have to alter their activities.

B. Comparison of Alternatives and Impacts

1. Alternative I - The Proposed Action

The proposed action is the offering for lease those unleased tracts within the proposed sale area (see Section II.A.1 for a complete description). Approximately 2 million acres or 360 tracts are located within the boundary of the proposed sale area. A Summary of Impacts expected to occur as a result of Proposed Sale No. 73 is contained in Section II.A.1.g.

2. Alternative II - Modify the Sale to Protect Sensitive Biological Areas

Alternative II would modify the sale area by eliminating 3 tracts and those portions of 4 tracts which coincide with a 10-mile zone centered on Morro Bay (see Figure II.A.2-1). This area represents approximately 23,000 acres (See Section II.A.2 for a complete description).

With the selection of Alternative II expected impact levels within the proposed sale area will remain essentially as stated in Alternative I. However, elminating tracts through selection of Alternative II would reduce the potential for impacts in Alternative I by ensuring time for cleanup, containment and weathering of an OCS platform oil spill as well as essentially reducing the

potential impacts to visual resources due to platform placement. Potential impacts to Morro Bay from Alternative I range from very low to high for the physical, biological and socioeconomic environment. With Alternative II if an oil spill occurrd and could be prevented from entering Morro Bay the potential impacts in Alternative I to the following resources would be reduced to insignificant: estuaries and wetlands reduced from high to insignificant; endangered species reduced from moderate to high to insignificant; commerical fisheries reduced from locally moderate to insignificant; visual resources reduced from low to insignificant.

3. Alternative III - Delay the Sale

Postponement of the Proposed Sale No. 73 would result in delay in the exploration, development, and production of oil and gas resources. A delay of the Sale may not change any of the impacts assumed to occur as a result of Alternative I. It would most likely postpone their occurrence. However, improvements may occur in technologies for oil spill prevention and recovery, deepwater drilling and production techniques, or for exploration and production in hostile environments which may lessen the risk of some adverse impacts. Also, new information on oil and gas resources may become available from drilling on adjacent existing leases and the economic feasibility of developing an area will probably improve.

4. Alternative IV - No Sale

This alternative removes the total area for proposed leasing at this time. All potential physical, biological, and socioeconomic impacts resulting from hydrocarbon exploration and development from Proposed Sale No. 73 would be eliminated at this time.

Although cancelling Proposed Sale No. 73 would eliminate all the impacts that are expected as a result of the proposal, activities within the region would still result from existing oil and gas activities from the previous OCS Sale No. 53, the State Tidelands development (refer to Sections IV.C.3 and D.4) and future OCS Lease Sales in this area, as well as importation of oil via tankers to refineries in the area (see Section III.C.13).

Changes to the Physical, Biological and Socioeconomic resources over the next 25 years without the proposal and future OCS Lease Sales would still occur. Population expansion and associated impacts will continue, and would be directly or indirectly responsible for most problems and benefits associated with non-oil related changes in Central California.

This alternative could cause our continued dependence upon imported oil and gas. Also, adverse environmental effects could result from continued and new production of domestic resources (e.g., coal, uranium, geothermal) in order to supplement existing energy sources. (See Section II.C Alternative Energy.)

C. Alternative Energy

Proposed Sale No. 73 is expected to lease tracts expected to contain undiscovered resources totaling approximately 291 million barrels of oil and 285 billion cubic feet of gas from 1988 to 2007. If this proposed sale was

removed from further consideraation, it could result in the continued or new development of alternate energy sources (see Table II.C-1). In order to supply the nation's energy needs without increasing our dependence upon foreign sources, the following alternate energy sources need to be further explored.

1. Onshore Oil and Gas: The U.S. Geological Survey (1981) estimates that onshore, undiscovered, recoverable oil resources ranged from 41.7 BBO with a 95 percent probability and 71.0 BBO with a 5 percent probability (mean - 54.6 BBO). Onshore natural gas resources range from 322.5 TCFG with a 95 percent probability and 567 TCFG with a 5 percent probability (mean 426.9 TCFG).

It was estimated that 1980's new field discoveries contain ultimate reserves of 504 million bbl of crude oil and gas condensate and 4.1 trillion cu ft of gas.

Despite the magnitude of undiscovered resources, domestic oil production is likely to continue to slump. Factors causing the slump in the first quarter of 1982 include: lower crude prices, lower prices for deep gas, great uncertainty over what Congress will do in the way of raising industry taxes and eliminating incentives, and adverse weather conditions in much of the Anadarko Basin (OGJ Report, June 21, 1982).

These factors have caused varying amounts of activity in the exploration of oil and gas onshore. In the Utah-southwest Wyoming producing area of the Western Overthrust Belt, drilling has been fairly steady. There has been a slight reduction in the exploration in other locations of the Overthrust Belt and in the associated Hingeline of Central Utah.

Deep wildcat wells are still probing the Eastern Overthrust Belt. Based on the age of the rocks and the production to date explorationists feel that the area may be gas prone, but it is still too early to rule out substantial oil discoveries at depth. Explorationists indicate that the "key" to unlocking the potential of the deep zones is probably 5 years away.

Activity in the Williston Basin of eastern Montana and North Dakota has decreased, although important discoveries have been found. High drilling and lease costs and falling prices have stopped activity (OGJ Report, June 21, 1982).

Activity in the Anadarko Basin was decreased partly due to a prolonged period of wet weather, in early 1982, and partly due to falling prices.

Onshore oil and gas development could entail environmental impacts such as land subsidence, increased erosion, loss of vegetative cover and wildlife habitat, increased air pollution, and disruption of existing land use patterns. Equipment failure, human error, and blowouts may also impair environmental quality. Water produced from EOR techniques, older well failures, and oil spills could result in ground and surface water pollution.

The magnitude of these impacts would depend on whether the increased production resulted from improved recovery methods or new discoveries. If improved recovery is realized, the impacts will likely be of lesser significance and will occur in already developed areas. Should new discoveries be found, the

TABLE II. C-1

ENERGY NEEDED FROM OTHER SOURCES TO REPLACE ANTICIPATED OIL AND GAS PRODUCTION FROM PROPOSED SALE NO. 73

Most Likely Resource Estimate	
Oil	291×10^6 barrels
Gas	285×10^9 cubic feet
Crude Oil Btu Equivalent	1629×10^{12} Btu[a]
Natural Gas Btu Equivalent	291×10^{12} Btu[b]
Total Oil and Gas Btu Equivalent	1920×10^{12} Btu
Coal Equivalent	80×10^6 tons[c]
Oil Sale Equivalent	203×10^6 tons[d]
Geothermal Equivalent	8310×10^6 KW[e]

[a]Assuming one barrel of oil equals 5.6 million Btu.
[b]Assuming one cubic foot of natural gas equals 1,021 Btu.
[c]Assuming one ton of coal equals 24 million Btu.
[d]Assuming high grade shale recovery of 0.7 barrels per ton of oil shale.
[e]Assuming 700,000 b/d of crude oil will generate 20 million KW of electricity.

impact will be more significant and disruptive, as a whole new infrastructure would have to be build from the ground up.

2. Coal: The United States is self-sufficient in bituminous coal and lignite. The Federal government owns an estimated 60 percent of the coal resources in Colorado, Montana, New Mexico, North Dakota, Utah and Wyoming. At the close of fiscal year 1979, 546 leases covered a total of 799,250 acres containing an estimated 17.6 billion tons of coal.

Most of the bituminous coal produced in the United States is burned to obtain thermal energy for generating electricity, processing raw or manufactured materials, and heating industrial complexes. Other uses include carbonization, gasification and liquifaction (see Section II.C).

The mining and combustion of coal can cause numerous environmental impacts to air, land and water. In the vicinity of the coal mine the problem of air pollution is principally related to fugitive dust from roads, transfer facilities, loading facilities, crushers, etc., and particulate matter (dust or fly ash) from thermal dryers and air cleaning tables. As coal, or any fossil or hydrocarbon fuel, is burned in a furnace to produce heat, products of combustion that may affect the environment have to be reduced to minimum concentration. Products of combustion are a complex mixture of gases and materials, mainly oxides of the fuel constituents--carbon, nitrogen, and sulfur--unburned carbon and a portion of the ash in the fuel. The ash material and unburned carbon in fine dust form is known as "particulate matter."

Coal can be mined by two methods, surface mining or underground mining. Production of coal by surface methods is now approaching 300 million tons annually, amounting to almost 50 percent of the total coal output. Mining by surface methods disturbs, thousands of acres of land annually. In addition, refuse piles, slurry ponds, abandoned mine structures, unprotected mine openings, and unsightly cleaning plants can also adversely affect land unless properly handled.

The use of water in coal mining is somewhat different than in most industries. With the exception of the small amount of water used in cleaning plants and for fire protection, most of the water encountered in coal mining operations is unwanted since it serves no useful purpose. In other words, it must be removed, otherwise it will interfere with mining operations. Mine drainage includes all types of mine water associated with coal mining operations. Mine drainage from coal mines may be acid, alkaline, or neutral, depending on the type of rocks or strata the water passes through, the distance it travels, and the time it remains in contact with soluble minerals. It can contain a lot of impurities or only a small amount. Thus, not all mine drainage is bad water.

3. Nuclear Power - Uranium: The predominant nuclear system in the United States is the uranium dioxide fueled, light water moderated and cooled nuclear power plant. Research and development is being directed toward other types of reactors, notably the breeder reactor or fusion reactors.

Although nuclear plants do not emit particulates or gaseous pollutants from combustion, the potential for serious environmental problems exists. Some airborne and liquid radioactive materials are released to the environment during normal operation. The amounts released are very small and potential exposure has been shown to be less than the average level of natural radiation exposure. The plants are designed and operated in such a way that the probability of harmful radioactivity released from accidents is very low.

This has been demonstrated in Pennsylvania where the Three-Mile Island Power Plant has been shut down since 1979 due to an accident inside the containment structure. However, even though harmful radioactivity was not released, and the area was not evacuated, there has been a large increase in public concern for the safety of these power plants. Attempts have been made to stop all future construction, and to shut down all existing nuclear plants. Dependence on this power source in some areas tends to preclude shut down as no suitable alternative is available.

Nuclear plants use essentially the same cooling process as fossil-fuel plants and thus share the problem of heat dissipation from cooling water. However, light water reactors require larger amounts of cooling water and discharge greater amounts of waste heat to the water than comparably sized fossil-fuel plants. The effects of thermal discharges may be beneficial in some though not all cases. Adverse effects can often be mitigated by use of cooling ponds or cooling towers.

Low level radioactive wastes from normal operation of a nuclear plant must be collected, placed in protective containers, and shipped to a Federally-licensed storage site and buried. High level wastes created within the fuel elements remain there until the fuel elements are processed. Currently, spent fuel is stored at NCR-licensed facilities. Plans call for recovering unused fuels at reprocessing plants, solidifying the wastes, and placing them in storage at a Federal Repository.

Although nuclear energy is a viable alternative energy source, uranium exploration and development has decreased. The factors which caused the reduction are 1) new and unexpected reactor cancellations and schedule delays, and 2) continued deterioration of the financial condition of the utility markets. The price of uranium has dropped from \$40.75/lb U_3O_8 on December 31, 1979, to \$17.50/lb U_3O_8 on October 31, 1982. This price decrease has caused numerous mines throughout the United States to shut down or reduce production.

The mining operation impacts are similar to those for coal mining with the exception of radioactive tailings and water being produced.

4. Geothermal Energy: Geothermal energy is the natural heat contained and continuously flowing from the earth. Today it is proving to be a viable source of energy for the generation of electricity and space heating. Workers in the field indicate that there are four different types of high grade geothermal reservoirs that may be exploitable; the hyperthermal system, the geopressured system, the molten rock system, and the hot dry rock system.

The hyperthermal systems which are being exploited around the world today have extremely high temperatures (500-600°F), at relatively shallow depths.

All occur in rock with a high water content. This water serves as a heat exchange medium which flows into the boreholes. The heat is then carried to the surface and to the electrical generating turbines with few technical problems. The pressure of the overlying rock and water keeps the water in the reservoir in liquid state, even when temperatures are far above the atmospheric boiling point. However, as the drill bit penetrates the cap rock of the reservoir, the pressure is relieved and the contained water flashes to steam. This type of occurrence is found at the Geysers, California and Lardarello, Italy.

The geothermal resource in the U.S. is large enough to power 20 million KW of electrical generating capacity by the year 2000. That is the equivalent of 700,000 b/d of crude oil, or about 8.5 percent of current U.S. oil output.

Presently, the Geysers geothermal field yields approximately 750,000 KW of electrical generating capacity. Union (principal operator) has plans which calls for another 200,000 KW of capacity. Predictions are that full development of the field will produce about 2 million KW of generating capacity by the end of the decade. Another development program is underway to develop the geothermal resources in the Imperial Valley.

Environmental impact which could result from the development of geothermal resources can vary depending upon the pre- and post-lease exploration and development activities. The amount of land used and altered ranges from zero in the very earliest stages of exploration to many tens of acres in a field which has undergone full scale development. Surface disturbing activities are generally, 1) road building, 2) drill pad or facility site construction, and 3) construction and clearance of pipeline and transmission line easement.

Steam and/or water can accidentally be discharged. Effluents released can consist of steam and/or hot water with dissolved salts and possibly noncondensible gases such as hydrogen sulfide, carbon dioxide, or ammonia. The accidental release of the toxic gases and water would result in air, water and noise pollution.

Subsidence and seismic activities may be accentuated during the production phase. The potential for subsidence is greatest in hot water systems produced from sediments (i.e., Imperial Valley). Since the majority of geothermal systems are in more competent rock they are not subjected to subsidence.

Geothermal systems are often found in areas of seismic activity. Possible fault movement can result from the removal and reinjection of fluids causing cyclic variations in reservoir pressures.

5. Synthetic Fuels: The synthetic fuel development has slowed down due to the sagging price of crude oil due to the world surplus. Oil price moderation, soaring costs, and lack of Federal assistance has led operators throughout the U.S. to shelve, delay or abandon commercial synfuel ventures. Some operators have kept their projects in order to alleviate future depression of fossil fuels.

a. Coal Gasification: Coal gasification seems to be the leading commercial scale synfuel projects throughout the world. A National Coal Association survey revealed that 30 coal-to-syngas projects were in operation in 1981. Of these, only eight are commercial operations. The remainder are demonstration, pilot, or process development units.

b. Coal Liquefaction: The only truly commercial synfuel production is the coal liquids produced at South Africa's Sasol plants. These three facilities convert coal mined on site into 27 different fuel and chemical products. The combined coal consumption of all three plants will be about 33 million metric tons/yr. It is predicted Sasol Ltd. could produce sufficient quantities of hydrocarbons to make South Africa self sufficient (E&MJ, November, 1982).

Environmental impacts from the development of coal liquefaction would be similar to those for mining coal (see Section II.C.2). Additional impacts would result from the coal liquefaction facility.

6. Oil Shale: Large areas of the United States are known to contain oil shale deposits with those in the Green River formation in Colorado, Wyoming, and Utah having the greatest commercial potential. The oil shale resources of the Green River formation are estimated at 54 billion bbl of recoverable oil in oil with an assay of 30 gal/ton and 600 billon bbl of reserves in place from shale with an assay exceeding 25 gal/ton. Therefore, the Green River formation represents 20-30 times the known reserves of conventional crude oil in the U.S.

Oil shale development poses serious environmental problems. With surface or conventional underground mining, it is very difficult to dispose of the huge quantities of spent shale, which occupy a larger volume than before the oil was extracted. Inducing revegetation in an area of oil shale development is difficult and may take more than 10 years. In-place processing avoids many of these environmental hazards. The spent shale problem is much less severe with underground processing.

However, the processing (retorting) operations consume large quantities of water and generate large amounts of wastewater. The wastewater must be treated and can be reused in the processes. It has been assumed that water pollution will not be a problem outside the complex. However, the limited availability of input water in the development area could lead to resource use conflicts.

Oil shale can be used in two main ways as an alternative energy source for the production from the proposed sale. The first is the retorting of the shale to produce oil, and the other is directly using the shale as a solid fuel, which is being done both in the Soviet Union and China (Deines and Mabad, 1979). Direct burning is inefficient and will result in large accumulation of waste and ashes adjacent to the power stations.

7. Hydroelectric Power: Hydropower is energy from falling water, which is used to drive turbines and thus produce electricity. Conventional hydroelectric developments convert the energy of natural regulated stream flows falling from a height to produce electric power. Pumped storage projects generate electric power by releasing water from an upper to a lower storage

pool and then pumping the water back to the upper pool for repeated use. A pumped storage project consumes more energy than it generates but converts offpeak, low value energy to high value peak energy.

Many of the major hydroelectric sites operating today were developed in the early 1950's. Thirty to forty years ago hydroelectric plants supplied as much as 30 percent of the electricity produced in the United States. Although hydroplant production has steadily increased, thermal-electric plant production has increased at a faster rate.

The undeveloped potential for hydroelectric generation is about 93,000 MW in the lower 48 states and about 32,000 MW in Alaska. However, it is likely that hydroelectric power will continue to represent a declining percentage of the total U.S. energy mix due to high capital costs, seasonal variations in waterflows, land use conflicts, environmental effects, water use, and flood control constraints. Sites with the greatest production capacity and lowest development costs have already been exploited.

Construction of a hydroelectric dam represents an irreversible commitment of the land resource beneath the dam and lake. Flooding eliminates wildlife habitat and prevents other uses such as agriculture, mining, and free-flowing river recreation. This is an economic cost which can greatly exceed the cost of the dam itself as was seen by one small hydroelectric facility in Pennsylvania which cost $15 million in 1971 for the dam, but relocation and property adjustment costs added $100 million to the cost of the project. This does not include the lost value of the wildlife habitat, the crops which would have grown, or the recreational activity in the natural environment. However, recreation will continue in the form of boating after the facility is completed.

8. Solar Energy: Applications of solar energy must take into account the following:

1) Solar energy is a diffuse, low intensity source.
2) Its intensity is continuously variable with the time of day, weather, and season.
3) Its availability differs widely between geographic areas.

The total solar energy intercepted by the earth is 5.9×10^{17} Btu per hour. This is reduced by the atmosphere to approximately 2.7×10^{17} Btu per hour which gives an average intensity of 1,450 Btu per square foot per day. This energy, although free, requires conversion to a suitable form. The major constraint on conversion is the size of the collector required, due to the low efficiency of photovoltaic generators (5-20%) . The large required collector area, at present, precludes commercial operation. A 1980 study by Jet Propulsion Laboratories shows that 52.7 percent of the electricity consumed in the San Fernando Valley could be produced by utilizing half of flat or south facing roofs in the area for photovoltaic collection. However, the cost of photovoltaic cells, $65 to $135 per square foot, makes this type of project uneconomic.

Another method of utilizing solar power is solar thermal, where the sun's rays are directed by mirrors to a central point, and are then capable of being used as the heating source for a thermal power plant. Southern

California Edison is using this concept in their experimental solar plant near Barstow. This plant came on line in 1982, and has an output of 10 megawatts.

Currently, the most prevalent use of solar power, both in active and passive systems, is in space and water heating in residential and commercial buildings. Some jurisdictions require solar energy concepts to be utilized in all new construction, and more industries are utilizing solar energy as a supplemental energy source.

Solar energy also includes wind energy and ocean thermal energy. Of these, wind energy conversion is presently being utilized in small scale operations with utility companies having test sites at various locations.

Ocean thermal energy is still in the experimental development stage, although the Department of Energy estimates that by the year 2000 ocean thermal energy conversion could replace 400,000 barrels of oil a day, equivalent to a power generation of 93 MWe. This system has been successfully tested on a small scale off Hawaii with a 10 MWe plant.

9. Bioconversion: Bioconversion is the process of transforming biomass into usable energy. Three methods of conversion are: 1) the conversion into liquid form (alcohol), 2) the conversion of organic waste into methane gas by bacterial breakdown of the biomass, and 3) the direct burning of source.

The first method mentioned is the conversion of organic matter into a liquid form, primarily alcohol. This can either be mixed with gasoline to produce gasohol, a product already in widespread use, or the alcohol can be burned directly in the vehicles. Brazil has replaced 20 percent of its gasoline with alcohol derived from plant matter.

The second method, the use of bacteria, is already in use on small scale in the U.S. An example is the Hyperion Sewage Treatment Plant in Los Angeles which uses produced methane to run the plant, and sells the excess to a municipal electrical generating plant.

California Edison is testing this concept in the [illegible] near Barstow. This plant cost [illegible] and has an output of 10 megawatts.

Currently, the most prevalent use of solar power, both in active and passive systems, is in space and water heating in residential and commercial buildings. Some jurisdictions require solar energy devices to be utilized in all new construction, and more industries are utilizing solar energy as a supplemental energy source.

Solar energy also includes wind energy and ocean thermal energy. Of these, wind energy conversion is presently being realized in [illegible] with utility companies having tested various locations.

Ocean thermal energy is still in the experimental stage, although the Department of Energy estimates that by the year 2000 ocean thermal energy conversion could replace 500,000 barrels of oil a day, equivalent to a power generation of 83 GWs. This system has been successfully tested on a small scale off Hawaii's [illegible] plant.

Biomass conversion: Biomass conversion refers to the process of transforming biomass into usable energy. Three methods of conversion are: 1) the conversion into liquid fuels (alcohol), 2) the creation of methane gas by bacterial breakdown of the biomass, and 3) the direct burning of sources.

The first method mentioned refers to the conversion of organic matter into a liquid form, primarily alcohol. This can either be mixed with gasoline to produce gasohol, a product already in widespread use, or the alcohol can be burned directly in the vehicles. Brazil has replaced 20 percent of its gasoline with alcohol derived from plant matter.

The second method, the use of bacteria, is already in use on small scale in the U.S. An example is the Hyperion Sewage Treatment Plant in Los Angeles which uses produced methane to run the plant, and sells the excess to a municipal electrical generating plant.

AFFECTED ENVIRONMENT

III.

CHAPTER III

III. AFFECTED ENVIRONMENT

A. Physical Environment

1. Geologic Description: Central California, in late Cretaceous time, was dominated by intense faulting, volcanism, and marine to nonmarine conditions associated with the interaction of plate boundaries. The Farallon Plate which lay between the obliquely converging North American and Pacific plates, was being subducted along the western margin of the North American Plate. Following the contact of the North American and Pacific plates, subduction was replaced by right-lateral, strike-slip faulting (Atwater, 1970). Strike-slip faulting along the San Andreas and associated faults persists as far north as Cape Mendocino. Presently, north of Cape Mendocino, the Gorda Juan de Fuca Plate is being subducted.

Granitic and metamorphic basement rocks of the Salinian block (Reed, 1933; Page, 1970) underlie northwest-trending Salinian province onshore, and extend offshore to form the basement beneath the central third of the central-northern California shelf. This block is separated from the block on the cordilleran on the east by the San Andreas fault, and from the Nacimento block on the west by the Sur-Nacimiento fault. Ross (1978) indicated the Salinian block is an allochthon surrounded, and probably underlain by Franciscan rocks (Ross and McCulloch, 1979). Caught between two major plates, right-lateral shear forces on the Salinian block have produced considerable internal strike-slip faulting.

North and south of the Salinian block, the shelf is condsidered to be underlain by the Franciscan assemblage (Jurasic, Cretaceous, and early Tertiary marine metasediments). Indications are that these marine sediments were once deeply buried, and a large portion of their erosional history occurred in the late Cretaceous or early Tertiary (Hoskins and Griffiths, 1971). Subsequent marine sedimentation proceeded through early Tertiary time, but renewed defromation and erosion left only remnants of the lower Tertiary deposits. Shelf-wide marine transgresseion then occurred and these deposits covered most of the present continental shelf and, in places, part of the adjacent slope.

Deformation through the mid-Tertiary was related to subduction; however, in upper mid-Miocene time, a change in tectonic forces initiated the formation of the continental shelf and the present shelf basins. Basement ridges were generally uplifted along the outer margins of the shelf (Curray, 1966) to form the seaward margins of the shallow basins. The shelf basins have acted as sites of deposition for marine sedimentation until late Pliocene time. Most basins contain doen-to-basin normal or high-angle, reverse faults along their eastern margins, and exhibit late Tertiary or Quaternary compressional folding.

These geologic basins (Eel River, Point Areana, Bodega, Santa Cruz, Outer Santa Cruz, and Santa Maria Basin Graphic No. 2) are situated on the contintal shelf or partially on the adjacent continental slope. Of the geologic basins formed during the upper mid-Miocene only the southern portion of the Santa Maria Basin is situated within the Proposed Sale Area. The term basin used in this document refers to the boundaries shown on Figure III.A.1.-1.

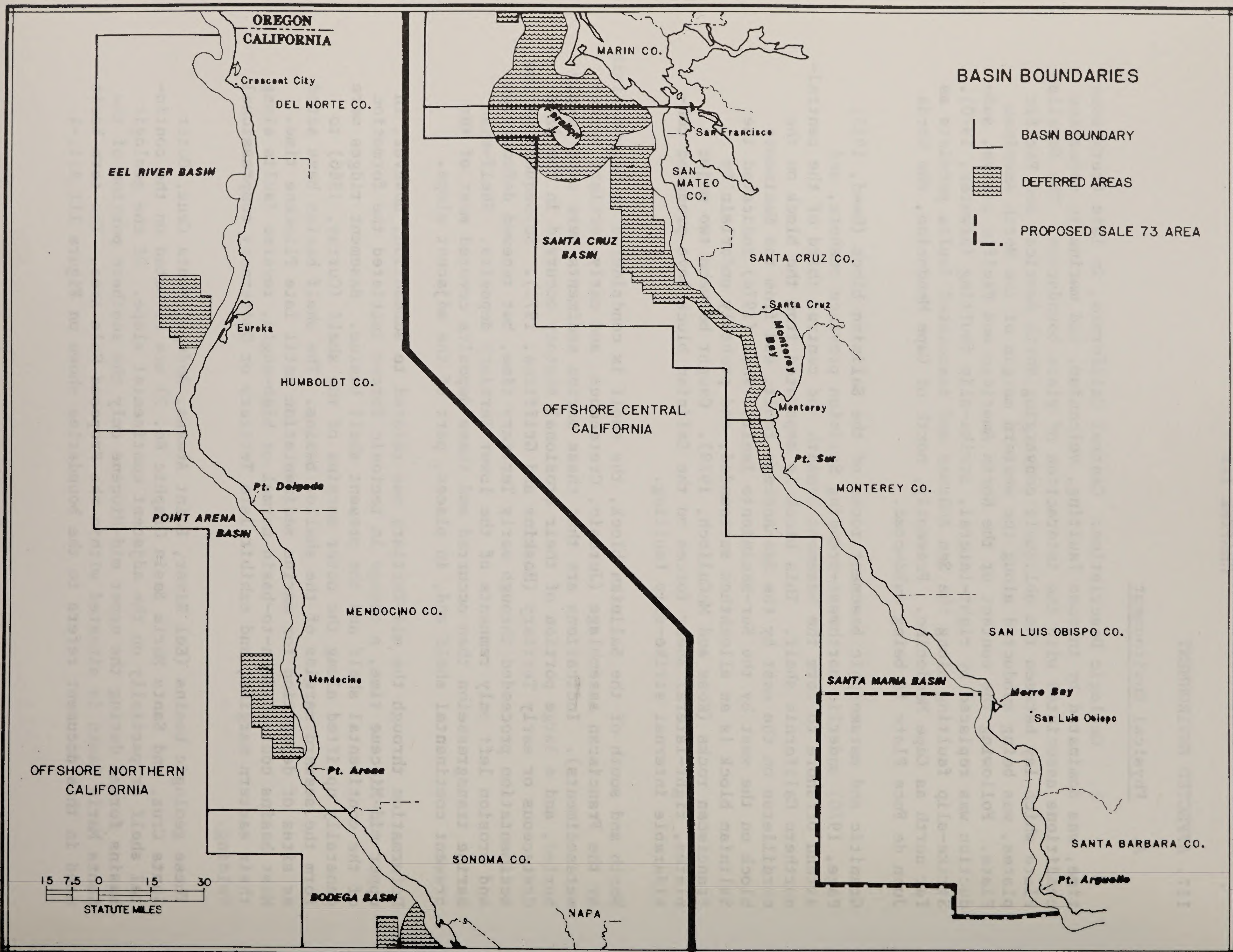


FIGURE III.A.1-1. BASIN BOUNDARIES IN CENTRAL AND NORTHERN CALIFORNIA

Santa Maria Basin. The southern most basin in the area of proposed OCS Lease Sale 73 measures approximately 40 km long x 230 km wide and is elongate parallel to the coast from Point Conception to Point Sur. It is bounded on the northwest by Franciscan basement rocks that have been elevated along major coastal faults, and on the southwest by the shallow Santa Lucia Bank formed by the Santa Lucia High, a structural block that is bounded on the east by the Santa Lucia Bank Fault. The northwest end of the basin continues onto the continental slope. The basin shallows to the south as it approaches the western end of the Tanasverse Range, but it continues south and east, and joins the western end of the Santa Barbara basin on the south side of the Transverse Range. The basin structure effectively trucates the western end of the Transverse Range (McCulloch, et al., in press).

The shallow Santa Lucia Banks is formed by the fault bounded Santa Lucia structural high. Vertical separation on the Santa Lucia Bank fault on the eastern margin of the high was accompanied by considerable strike-slip displacement. Northwestward transport of this structural high is also suggested by the similarity of the physiography and gross structure of this part of the shelf with that of the California Borderland to the south (McCulloch and et. al., 1980).

Structural trends (fold axes and faults) in the northern two-thirds of the basin parallel the shoreline. The structures generally appear to have been initiated by at least early Tertiary time, and most persisted into late Miocene, but the associated faulting and deformation is considerably less above the early Tertiary unconformity. Just south of Point Sur there is evidence for present day compression and thrusting in the basin sediments that lie adjacent to the high angle reverse fault that bounds the northeast edge of the basin (McCulloch, et al., in press). Structural trends in the southern third of the basin are north-south, oblique to the shoreline and the bounding Santa Lucia High (Hoskins and Griffiths, 1971). Considerable evidence for compression is also present in this area. Low-angle thrusting, with a vergenz to the west started by at least early Tertiary time, and appears to have continued through Tertiary and Quaternary time.

A detailed geological summary of the Sale area may be found in McCulloch, et. al., in press, U.S. Geological Survey Open File Report 82-___, pages 2 through 28.

2. Geologic Hazards: Geologic Hazards in parts of central northern California shelf basins have been previously described by McCulloch, et al., (1980), Field, et al., (1980), Richmond, et at., (1981) and McCulloch, (1982). Although these hazards studies were of limited areas, they help to describe the kind of hazards that may occur elsewhere on the shelf. However, to adequately define the geologic hazards in the area, additional surveys and fieldwork need to be performed.

The Geologic Hazard Graphic No. 3 is a composite of maps contained in reports by McCulloch, et al., (1980), Field, et al., (1980) and McCulloch, (1982). This visual provides a regional scale representation of the geologic hazards for those portions of central-northern California for which there are publicly available data.

Instability of the sea floor, whether from seismic activity or sedimentary processes, is recognized as the principal hazard to emplacement of platforms and pipelines in the marine environment. Hazards related directly to seismic activity include ground shaking, fault rupture, generation of tsunamis, and earthquake-induced ground failures such as liquefaction and slumping. Recent analysis of earthquake strong motion records (Joyner and Boore, 1981) have shown not only that accelerations in excess of the force of gravity can accompany large earthquakes, but that these high accelerations persist with little diminution for several kilometers away from the fault.

Faults showing displacement of either the sea floor or young (less than 11,000 years) sediments as well as those associated with historical earthquakes are considered active and therefore potentially hazardous to development. The major seismically active faults (refer to Geologic Structure Graphic No. 2) that bound the geologic basins have either produced large earthquakes (1906, 1927), or on the basis of mapped length, appear to be capable of producing earthquakes larger than magnitude 7.

As noted above, a large earthquake might have considerable effect on the stability of unconsolidated sediment on the shelf and slope. Based upon onshore ground failures that have accompanied large earthquakes, considerable mobilization of offshore unconsolidated sediment, may be expected to accompany seismic activity probably largely by liquefaction. Mobilization will be accompanied by downslope movement, even on gentle slopes(5°), movement toward local topographic lows, such as sea floor drainage ways, and a loss of bearing strength. This earthquake-induced behavior of unconsolidated sediment was observed onshore in many areas as a result of the 1906 San Andreas earthquake (Youd and Hoose, 1978). This type of soil failures caused considerable damage to modern buildings, roads and bridges over a wide area in the 1964 Alaskan earthquake (Kachadoorian, 1968; McCulloch and Bonilla, 1970). It should be emphasized that earthquake-generated slope failures and lateral displacements were common even on very gentle slopes (0.25°). Thus similar failures might be expected on the continental shelf as well as on the more steeply sloping continental slope (Field, et al., 1982).

Instability of the sea floor can also result from dynamic (e.g., wave surge) and static (e.g., gravity) forces acting independently of seismic activity. Some areas of the sea floor are prone to mass movement (e.g., slumps, slides) or other forms of sediment transport (flows, creep, or current scour). Oil and gas seeps, while not inherently hazardous, may provide clues to the location of fractured reservoir rocks and shallow over-pressured gas pockets that can pose a danger to drilling operations if not anticipated and properly planned for.

The occurrence of gas increases chances for blowouts, which are considered to be the most costly and feared operational hazards related to oil and gas operations (Danenberger, 1980). Gas may decrease soil strength, and careful consideration must be given to gas content when designing foundations for bottom founded structures. As shown in the following discussion of the Santa Maria Basin, the basin is adjacent to one or more seismically active faults, and can be expected to experience seismically-induced ground motion. Slumps and slides have been mapped offshore Santa Maria Basin, and evidence for shallow gas exists in, or adjacent to, the basin.

Geologic hazards in the Santa Maria Basin are shallow gas and gas-charged sediments, shallow slope failures, potential fault rupture of the sea floor, relatively strong seismic shaking, and stup slopes .

High-amplitude seismic reflections (bright spots) indicate possible accumulations of gas near tops of anticlines in the Neogene rocks. The gas appears to be migrating upward in these structure and up dip toward shore.

Shallow slope failures (tens of meters of unconsolidated sediments) have occurred on gentle slopes (less than 2°) at water depths greater than 300 m. Indications are that the mass transport may have resulted from a loss of soil strength due to seismic shaking. The failures also occur in areas of gas charged sediments, which may have contributed to the failure by decreasing soil strength.

Steep-walled submarine channels, which comprise the upper reaches of the Arguello Canyon system, incise the continental shelf and slope of southern Santa Maria basin. Unconsolidated sediments floor all of these channels and form at least a thin skin on the channel walls. Steep wall slopes, greater than 10°, are common in all of the channels. Several subparallel, southwest-trending buried channels are associated with the Modern sea-floor channels.

The Santa Maria Basin is bounded on the east and west by relatively long (100 km) seismically active faults. The eastern side is bounded by the Hosgri fault thought to have produced the M.7.3 Lompoc earthquake in 1927 (Gawthrop, 1975). Profiles across the Hosgri fault zone (Wagner, 1974) show considerable verticle separation, along which presumed Franciscan basement rocks have been uplifted to near the surface. The displacement history of the fault zone is controversial.

Recent epicenter determinations show that the Hosgri fault is presently seismically active (McCulloch, 1982). It has been suggested that the Hosgri fault and the San Gregorio fault to the north are part of a major strike-slip fault system that joins the San Andreas fault in the Gulf of the Farallones (Greene and others, 1973; Graham, 1976). Studies that relate fault length to potential earthquake magnitude (e.g. Bonilla, 1967) indicate that such a fault would be capable of producing earthquakes in excess of magnitude 7. Thus there may be the potential for a large earthquake along the eastern side of the offshore Santa Maria Basin and the eastern side of the Gulf of the Farallones.

In the southern half of the offshore Santa Maria Basin, there is seismic activity associated with relatively straight north-northwest-trending faults on, and adjacent to, Santa Lucia Bank, the structural and physiographic high that forms the western edge of the basin. The most continuous fault, the Santa Lucia Bank fault, appears to be largely a right-lateral slip fault along which there was significant displacement until at least late Tertiary time (McCulloch et al., 1980a; Page et al., 1979). First motion solutions for several seismic events suggest that the recent displacement is by thrusting. The sea floor is offset along some of the faults on Santa Lucia Bank, as it is along several faults on the western edge of the northern part of the basin. The sea floor offset may be due in part to recent movement and in part to the preservation of old offsets in an area where recent sedimentation is low.

Adjustments to the motion between the North American and Pacific Plates appear to be taking place across the basin. Strong seismic shaking can be expected in the eastern part of the basin associated with the Hosgri fault. Seismic activity associated with faults along the western edge of the basin is largely confined to the southern part of the basin where the faults are relatively straight, and largely excluded from the northern area where the faults and associated structures appear to have been refolded.

3. Non-Petroleum Mineral Resources: Many varieties of non-petroleum resources are located in the ocean and on or beneath the ocean floor. Contained on the California continental margin are vast quantities of sand and gravel and associated heavy mineral deposits and phosphorite. There is an increased interest in these deposits due to 1) increasing shortages of the resources; 2) the expanding need for new sources of these minerals to reduce the pressure on existing supplies and, in certain instances, to lessen the environmental impacts of surface mining; 3) to reduce the United States dependency on foreign sources; 4) the availability of economically and technologically feasible offshore recovery systems.

The most exploitable of these resources along the California Coast are the beach and nearshore deposits of sand and gravel. These deposits are derived from three principal sources: sand dunes, glacial deposits of Pleistocene age, and sediments which have been transported to the coast by streams and rivers. Sand and gravel have a wide variety of uses. Traditionally, they have been used as construction aggregate, ballast, fill, and possibly for beach replenishment or restoration. However, depending upon the physical and chemical properties, the sand can be used for the manufacturing of glass and ceramics, as well as for filtration and grinding. Extending from south of Monterey Bay to Point Conception, the most extensive gravel deposits (west of Big Sur) cover an area of a quarter square kilometer. The coarse sand deposits which are present in this area each have an average coverage of about a quarter to a half square kilometer. The most prolific sedimentary deposits in this area, south of Monterey Bay, are the sand deposits. These deposits, which appear to be deltaic progradation existing in a high energy regime, each cover an average area of approximately 2 km^2 and are found west of Big Sur, Santa Maria, and Lompoc.

Associated with sand and gravel are placer deposits. These deposits are superficial mineral deposits formed by the mechanical concentration of mineral particles weathered from various sources. Marine placers usually contain concentrations of heavy and chemically resistant minerals; the most abundant of these minerals found in California waters is magnetite and ilmenite. Less abundant but associated with black sands, are gold, and the platinum group metals, tin, inert oxides, and silicates (i.e., chromite, garnet, rutile). Relatively insoluble sulfides such as cinnabar have also been recovered in small amounts. Although rare, there have been reported occurrences of Zircon heavy mineral concentrations at Point Sal.

Authigenic phosphorite is a phosphorous-rich rock which is an important marine mineral that may prove to be economically valuable in the near future. Phosphorous is one of the three major nutrients (carbon, nitrogen, and phosphorous) needed for plant life processes. Phosphorite found in the marine environments occurs in several forms as nodules, as phosphate sands

and muds, and as beds of consolidated sediments in consolidated rock. The waters offshore from San Luis Obispo to Point Conception are characterized by upwelling and may be associated with phosphorite authigenisis.

Wilson and Mero (1966) indicate that phosphorite deposits are known to extend from coastal waters off Point Reyes north of San Francisco, southward 12,000 km to the mouth of the Gulf of California. Many of the known deposits are found south of Point Conception. Phosphorite nodules found along the California Coast may occur in some places within a few kilometers off the coast and extend as far from shore as the inner edge of the continental slope. The water depth at which phosphorite exists ranges from 30 m to 2,500 m. Since the origin of phosphorite may be associated with upwelling, we may extrapolate existing upwelling data as an indication of potential sites for submarine phosphorite formation, Figure III.A.4-1.

Glauconite is an authigenic sea-floor mineral of potential economic interest that is found in widespread occurrence off the Coast of California. This mineral contains from 2-9% K_2O and could serve as a future source of potash and soil conditioner for agricultural use, or as a source of potassium or potassium salts. Compared to continental deposits of potash salts, marine glauconite sediments could not be considered a rich source of supply; however, mining costs would be relatively cheap and mechanical concentration might possibly produce a product with a significant amount of contained potash. Glauconite is widely distributed in the terrigenous sediments off the coast of the state, occurring in water depths ranging from 200 to 400 m. The highest concentrations of glauconite occur in environments in which detrital sedimentation is slow or virtually absent, such as banks, ridges, and upper slopes of basins of the continental shelf. Distribution of the mineral is normally patchy both laterally and vertically.

4. Physical Oceanography: This section briefly summarizes the physical and chemical characteristics and some oceanographic forces found off Central California. For a more complete review of Central California physical and chemical oceanography, see Winzler and Kelly (1977), Hickey (1978), and Williams (1980). Additional data will be forthcoming from the CODE and SuperCODE projects funded by NSF and the study of circulation funded by the BLM.

Oceanic Water Circulation and Water Mass Characterization. The ocean water adjacent to the California Coast is basically characterized by the southern flowing subarctic water of the California Current. The water mass of the California Current is modified by a deep (200 m) undercurrent that flows northwest from Baja California to north of Cape Mendocino. Additionally, the circulation pattern and water characteristic structure along the Central California Coast fluctuate due to seasonal climatic changes.

The three distinct seasons or periods along the Central California Coast are: the oceanic period (July until the middle of November); the Davidson Current period (mid November until the middle of February); and the upwelling period (mid February until the end of August). The Oceanic Period is the season when the California Current dominates the circulation pattern. The California Current is best described as a meandering, diffuse, southeastward

flow, with short-term variations in speed. The average speed has been reported to be between 10 and 25 cm/sec, while the maximum speed has attained speeds of 50 cm/sec (Schwartzlose and Reid, 1972). Although there is no true western edge to the California Current, it has been reported to extend 600 to 1,000 km offshore, and is found above 100 to 500 m. The southward flowing California Current transports low-temperature, low-salinity, high nutrient (high uM phosphate) and highly oxygenated (7.8 ml O_2/l) subarctic water (Wyllie and Lynn, 1971; Thomas and Seibert, 1974; CalCOFI, 1963; Emery, 1960).

The Davidson Countercurrent, which appears nearshore during the Davidson period, may be the surface expression of the northward flowing Equatorial water undercurrent. The Davidson Current develops in the winter when the winds are northward along the California Coast. The Davidson Current lies landward of the California Current and extends to approximately 80 km offshore with speeds measured between 16 and 47 cm/sec (Schwartzlose and Reid, 1972; Schwartzlose, 1963). The characteristics of the deep flowing Equatorial Pacific water that emerges to form the Davidson Current are warm, high-salinity, nutrient-rich (high uM phosphate), and oxygen poor (to F0.25 ml O_2/l) (Wyllie and Lynn, 1971; Thomas and Seibert, 1974; Emery, 1960).

Coastal upwelling, present during the upwelling period, is part of a large scale oceanic process that takes place along the western edge of continents. As the wind blows parallel to the coast in the direction of the current, surface layers of the ocean surface are transported offshore, and the deeper water moves to the surface (upwelling) replacing the water moved off shore. The upwelled water is usually low temperature, high salinity, and most importantly, nutrient-rich water; high in nitrates, phosphates, and silicates essential for high phytoplankton production in the surface layers of the ocean. The upwelling process, thus, acts as a conveyor of nutrients from the depths (generally less than 200 m in California), renewing the surface water and helping to bring about large phytoplankton blooms, rich zooplankton production and abundant fisheries production. Figure III.A.4-1 shows areas of upwelling along the Central California Coast.

Nearshore current data for most of the Central California coastline is lacking.

Surface currents in Central California are primarily wind driven, leading to seasonal variability in patterns. Patterns noted are based on rather short-term studies in most cases or derived from a synthesis of observations from a variety of techniques. The numbers of observations are not equal for all methods employed and not equal among areas or among oceanic periods.

Drifter studies show a complex pattern of surface circulation along the Central California Coast, and because of limited numbers of releases, very little statistical reliability may be attributed to the patterns indicated. Depending on the timing of drifter release and place of release, the trajectories may go into, out of, or north of Monterey Bay or into or north of San Francisco Bay. Only one drifter release is archived for Northern California and it indicated a southward circulation for April after release just south of Cape Mendocino.

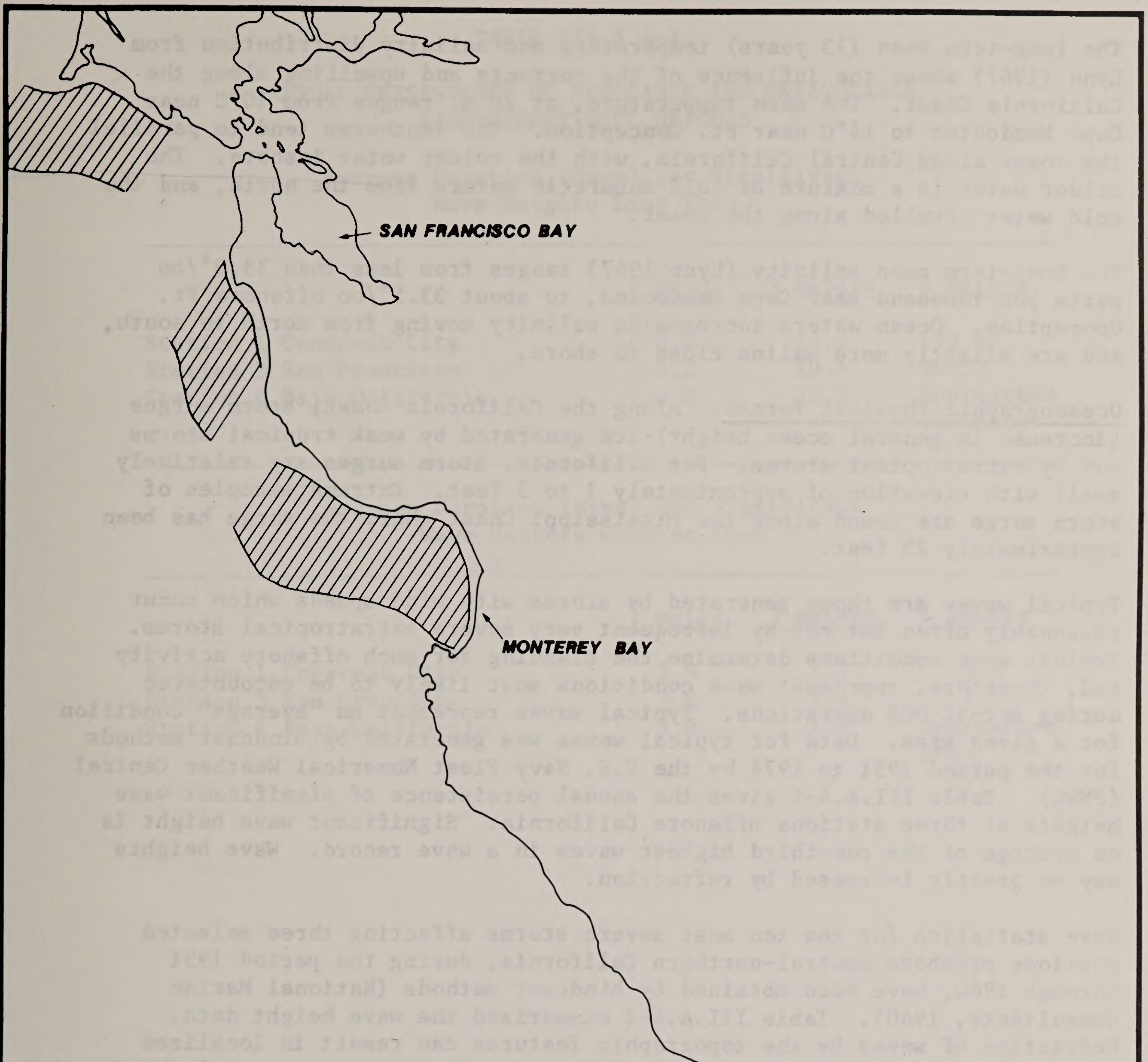


FIGURE III.A.4-1 MAJOR UPWELLING AREAS DURING UPWELLING SEASON (FEBRUARY - JULY).

The long-term mean (13 years) temperature and salinity distribution from Lynn (1967) shows the influence of the currents and upwelling along the California Coast. The mean temperature, at 10 m, ranges from 10°C near Cape Mendocino to 14°C near Pt. Conception. The isotherms tend to parallel the coast along Central California, with the colder water inshore. The colder water is a mixture of cold subarctic waters from the north, and the cold water upwelled along the coast.

The long-term mean salinity (Lynn 1967) ranges from less than 33.0°/oo parts per thousand near Cape Mendocino, to about 33.5°/oo offshore Pt. Conception. Ocean waters increase in salinity moving from north to south, and are slightly more saline close to shore.

<u>Oceanographic Physical Forces</u>. Along the California Coast, storm surges (increase in general ocean height) are generated by weak tropical storms and by extratropical storms. For California, storm surges are relatively small with elevation of approximately 1 to 3 feet. Extreme examples of storm surge are found along the Mississippi Coast where the surge has been approximately 25 feet.

Typical waves are those generated by storms with wind speeds which occur reasonably often but not by infrequent very severe extratropical storms. Typical wave conditions determine the planning for much offshore activity and, therefore, represent wave conditions most likely to be encountered during actual OCS operations. Typical waves represent an "average" condition for a given area. Data for typical waves was generated by hindcast methods for the period 1951 to 1974 by the U.S. Navy Fleet Numerical Weather Central (FNWC). Table III.A.4-1 gives the annual persistence of significant wave heights at three stations offshore California. Significant wave height is an average of the one-third highest waves in a wave record. Wave heights may be greatly increased by refraction.

Wave statistics for the ten most severe storms affecting three selected stations offshore central-northern California, during the period 1951 through 1960, have been obtained by hindcast methods (National Marine Consultants, 1960). Table III.A.4-2 summarized the wave height data. Refraction of waves by the topographic features can result in localized concentration of wave energy with heights considerably in excess of those indicated in Table III.A.4-2.

Tsunamis or seismic sea waves are gravity waves which are associated with seismic disturbances. Tsunamis, of noticeable size in deep water (approximately 1 m), have periods of 8-55 minutes and lengths of 20 to 30 miles. Areas of highest seismic activity, which could potentially generate a tsunami, are the Aleutian trench area, the Gulf of Alaska, and the Kamchatka Peninsula. California Division of Mines and Geology have shown that damage from a tsunamis in California has almost always been greatest at Crescent City in Del Norte County, regardless of points of origin. The Division of Mines and Geology predict that Tsunamis from distant sources will arrive on the average once every 20 years. Along most of the central-northern California Coast there is a moderate potential, with a high recurrence rate, for damage from high water and swift current resulting from tsunamis.

TABLE III.A.4-1

ANNUAL PERSISTENCE OF FAVORABLE AND UNFAVORABLE SIGNIFICANT WAVE HEIGHTS

Average Duration (days) for Significant Wave Heights Less Than

	1 meter	3 meters	6 meters
Station 1 Crescent City	3.0	17.5	193.4
Station 3 San Francisco	3.2	29.4	968.7
Station 6 Baja California	2.8	22.8	Approaches infinity

Average Duration (days) for Significant Wave Heights Greater Than

	1 meter	3 meters	6 meters
Station 1 Crescent City	3.9	1.7	1.3
Station 3 San Francisco	3.8	1.4	1.0
Station 6 Baja California	5.9	1.4	Approaches zero

TABLE III.A.4-2

CHARACTERISTICS OF TEN MOST SEVERE STORMS AFFECTING SELECTED STATIONS DURING PERIOD 1951-1960[a]

Station[b]	1	2	3
Storm Date	Largest Significant Wave Height (ft.)		
12-51	26	20	18
12-52	22	20	16
1-53	20	21	20
2-54	23	21	18
3-56	20	20	15
2-58	20	19	18
4-58	20	24	26
11-58	21	21	20
2-59	20	23	20
2-60	32	34	33

[a]From National Marine Consultants 1960.

[b]Station locations as follows:

Station 1	42.0°N 125.0°W	offshore California-Oregon Border
Station 2	39.6°N 124.5°W	offshore Ft. Bragg, California
Station 3	37.6°N 123.5°W	offshore San Francisco, west of Farallon Islands

5. Chemical Oceanography: Chemical oceanography of the Proposed Sale No. 73 area is discussed briefly below. Detailed reviews of the chemical and temperature characteristics of the Central California Coast waters may be found in Winzler and Kelly (1977), Jones and Stokes (1980), U.S. Dept. of the Interior (1978), U.S. Dept. of the Interior (1980), Emery (1960), and the numerous CalCOFI Atlases (1963 to 1979).

Temperature. Ocean temperatures along the California Coast vary with the three main oceanic circulation regimes; Davidson, Upwelling and Oceanic. Lowest temperatures at the surface occur during the Upwelling Season and range from 11°C to 13°C for Central California nearshore waters. Highest surface temperatures occur after the Upwelling Season and range from 14°C to 16°C for Central California nearshore. Offshore and nearshore (within 60 miles) waters differ by only a few degrees. Temperature anomalies (unusually high or low average temperatures) can and do occur in Central California and may persist for 2 years.

Salinity. Salinity of California ocean waters varies only a small degree seasonally and non-seasonal variability predominates. Surface salinity varies from 33.0 parts per thousand in winter and spring along the coast to 33.6 parts per thousand during summer. Salinity varies with depth and water mass along the California Coast and presents a complex pattern.

Oxygen. Surface waters in the California Current are generally saturated down to the thermocline with oxygen which then decreases to an oxygen minimum layer between 700 m and 1,000 m. Below the oxygen minimum layer, there is a gradual increase in oxygen content with depth with the oxygen level of deep waters being relatively constant for hundreds of meters. Oxygen levels vary from surface saturated levels of 7 to 6 ml/l to 0.4 ml/l at the oxygen minimum layer and increasing to 2.6 ml/l at 2000-3000 meters.

Nutrients. The major nutrients characterizing marine waters are phosphate, nitrate, and silicate. These fluctuate with season and depth, the highest surface levels of nutrients being found during the Upwelling Season. Additional sources of nutrients are the major sewage outfalls of urban areas along the coast and areas of agricultural runoff (nutrients from fertilizers). An extensive data base on nutrient levels in California marine waters is contained in the CalCOFI investigations.

Turbidity. Turbidity is measured by Secchi Disk Depths (a light colored disk is lowered until it cannot be seen from the surface and this depth is recorded) and typical values for coastal waters along California are 2 to 10 meters. Open ocean Secchi depths are greater and may be 50 meters. Turbidity increases during spring river runoff when sediments may be carried far out to sea by rivers in Central California.

6. Water Quality: Water quality is defined here as the degree to which chemical concentrations and physical parameters within a water mass approach ambient or natural water conditions. The closer chemical and physical characteristics come to natural conditions the higher the water quality. The following definitions although somewhat subjective are used to describe water quality in this document.

High (Pristine) - Normal measures of water quality such as oxygen content, salinity, temperature, transmittance, trace metal concentrations, and hydrocarbon levels show no stable statistically significant changes from ambient conditions.

Good - Some measures of water quality may deviate from ambient measures but return quickly (1-2 days) to ambient.

Poor - Water quality suffers from elevated levels of toxic trace metals or hydrocarbons neither of which approaches EPA safe levels. Increased levels of these materials may persist for days to weeks.

Very Poor - Water quality is degraded by levels of trace metals, hydrocarbons, sewage, coliform bacteria, or other pollutants which exceed EPA safe levels. Conditions persist for months or longer and may present human health hazards.

Water quality data are sparse for marine waters along the Central and Northern California Coast. Miller and McGrew (1977) have summarized existing data and their report should be reviewed for detailed descriptions of water quality. Federal (EPA Water Quality Criteria) and State (California Ocean Plan) regulations and guidelines have been developed to ensure the highest level of water quality. This section will briefly describe existing water quality in the Proposed OCS Sale No. 73 area.

Water quality is dependent upon a number of local factors: currents, freshwater inflow, the number and nature of ocean discharges, outfalls, and human activities. Human activities that affect oceanic waters are: discharge of municipal and industrial wastes, cooling water discharges, street surface runoff, accidental oil spillage, dredging, and vessel wastes.

Overall, the oceanic water quality along Central California appears to be very good to high. The exception to the generally high water quality are found in the areas adjacent to centers of population and in some harbors and embayments.

Water quality and source of pollutants for 7 bays and sloughs along the Central California Coast are listed in Table III.A.6-1. San Francisco has particularly poor water quality due to industrial and commercial activity as well as sewage and agricultural effluents. This poor water quality is additionally degrading the quality of adjacent oceanic water. From the data on bays and sloughs along the coast, 50 percent of the sites investigated were found to have degraded water quality in general due to sewage problems.

Determination of water quality along the coast was based upon reliable water column and mussel analyses. The mussel (*Mytilus sp.*) is used as an indicator of pollution because of the mussel's ability to concentrate pollutants above ambient seawater levels and integrate the pollutant exposure over time. Through the State and national mussel watch program, mussels (*Mytilus sp.*) from the California Coast were analyzed for selected trace metals (Moss Landing Marine Laboratories) and hydrocarbons (Bodega Bay Marine Laboratory). Stephenson, Martin and Martin (1978) point out that three metals, lead (Pb), silver (Ag), and zinc (Zn), analyzed for in the mussel program, were found to reflect anthropogenic input. The geographical variation of these metal concentrations shows that there is an overall

TABLE III.A.6-1

CENTRAL CALIFORNIA EMBAYMENTS AND SLOUGHS[a] WATER QUALITY

Location	Water Quality Comment
1. San Luis Obispo Bay	Good water quality.
2. Estero and Morro Bay	Elevated coliform concentrations due to stormwater runoff from dairy operations.
3. Carmel Bay	Good water quality.
4. Monterey Bay	Water quality in various areas of Monterey Bay is degraded due to discharged sewage effluent.
5. Moss Landing Harbor/ Elkhorn Slough	Water quality has been degraded by discharge from dairy operations, treated domestic sewage, and industrial (PG&E) power plant and a magnesia refactory) concerns.
6. Half Moon Bay	No significant water quality problems.
7. San Francisco Bay	In general, poor water quality is found throughout San Francisco Bay. Water quality problems are due to heavy metals, hydrocarbons, high coliform levels, and depressed dissolved oxygen levels.

[a]Stephenson, Martin, and Martin, 1978.

increase in metal concentration toward the south and higher concentrations of metals are found adjacent to centers of high population. Risebrough, R.W., (1978) mussel watch report shows results similar to the trace metal report by Stephenson, Martin, and Martin. Along highly populated coastal areas, hydrocarbons (petrogenic origin) were found to be at increased levels as shown in Table III.A.6-2. In addition to increased hydrocarbon levels that result from anthropogenic activity, increased hydrocarbon levels were found at Goleta where offshore oil seeps exist. Trace metal water column samples collected in the surface oceanic waters along the central-northern California Coast were analyzed by Bruland (personal communication, August 1979). These samples, shown in Table III.A.6-3, appear to be relatively clean or unaffected by anthropogenic activities. Kauner, Gordon, and Martin (personal communication, 1979) have conducted trace metal analysis of marine waters from within San Francisco Bay and oceanic waters adjacent to San Francisco Bay (Table III.A.6-4). Comparing the trace metal levels from the San Francisco Bay area and the general trace metal levels from the central-northern California Coast, the trace metal levels from water samples within and outside San Francisco Bay are higher than the trace metal levels along the general central-northern California Coast. This comparison reflects the influence anthropogenic acitivities from the San Francisco Bay area have on adjacent oceanic waters.

In addition to addressing the quality of marine waters offshore Central California, it is useful to consider the geohydrological characteristics of coastal California and the quality of associated groundwater.

At present, a major portion of the water supply of the central coastal area of California comes from local groundwater basins. The sedimentary horizons, in these groundwater basins, often form discrete aquifers. Aquifers in coastal plains may continue offshore and the freshwater they contain could be an integral part of an area's water resource. An example might be groundwater in the Arroyo Grande Area (San Luis Obispo County) which appears to extend offshore beneath the Santa Maria Basin.

7. Ocean Dumping: Ocean dumping has been, and still remains, an accepted means of disposal of waste material from the Coastal States. Off the coast of Central California, there are 29 designated historic and active dump sites. The materials dumped at each of these sites depend upon the type of permit which was issued for that site by the Environmental Protection Agency. The waste materials have consisted of substances such as low level radioactive waste, obsolete munitions, industrial waste, toxic chemicals and dredge spoils.

Low level radioactive waste has not been disposed at sea since 1970 (Brown 1971, EPA 1980) when disposal by shallow land burial became the accepted means of disposal. The U.S. Navy however discharges low level waste from operations of nuclear vessels at sea (NAS, 1971) in accordance with specific Nuclear Regulatory Commission requirements (10 CFR 20.302). The Navy at sea discharges are not solid waste and are therefore not subject to impact from the proposal.

In Central California waters, there are 16 active dredge spoil sites. None of these sites are located within the boundary of Proposed Sale No. 73. There are four low level radioactive dump sites off Central California, all on the Federal OCS. One low level radioactive waste dump site is located

TABLE III.A.6-2

MUSSEL (MYTILUS SP.) HYDROCARBON CONCENTRATIONS FROM SELECTED SITES ALONG THE CALIFORNIA COAST

Location	N[b]	Concentration (ug/g Dry Wt.)
So. California Islands	14	12 ± 4
San Diego Harbor	1	220
Los Angeles Harbor	1	270
Goleta	4	440 ± 230
South Shore (Pt. Conception to La Jolla except harbors)	12	64 ± 68
Morro Bay	1	28
Central Coast (Excluding Pacific Grove) Pt. Arguello to Farallon Islands	16	9 ± 4
Pacific Grove	2	15 ± 15
Elkhorn Slough	1	49
San Francisco Bay	1	180
Tomales Bay	1	10
Humboldt	3	96 ± 6
Northern California Coast[a]	16	9 ± 4

[a]Pt. Reyes to Redwood del Norte

[b]N = No. of samples (1 sample = 20 individuals).

Source: Risebrough, personal communication August 1979.
(R. W. Risebrough, et al., 1979)

TABLE III.A.6-3
TRACE METAL LEVELS FOR SURFACE OCEANIC WATERS
ALONG CENTRAL AND NORTHERN CALIFORNIA

Metal	Concentration (ng/kg)
Manganeze (Mn)	100 - 300
Nickle (Ni)	200 (approximately)
Cadmium (Cd)	4 - 25
Lead (Pb)	5 - 15
Zinc (Zn)	5 - 30
Copper (Cu)	100 (approximately)

Note: The trace metal information for the general area of Central and Northern California was taken from surface water outside the influence of ocean wate discharges.

Source: Bruland, personal communication August 1979.

TABLE III.A.6-4
TRACE METAL LEVELS FOR SURFACE WATERS
WITHIN AND OUTSIDE SAN FRANCISCO BAY

Location Metal (ng/l)	San Pablo Bay	Alcatraz	Just Outside S.F.Bay	Farallons	General Area Around Proposed San Francisco Municipal Outfall
Manganese (Mn)	5310	7620	5770	851	309-2400
Nickle (Ni)	2040	1210	913	322	235-591
Lead (Pb)	10	42	203	20	20-63
Zinc (Zn)	904	524	330	43	64-358
Copper (Cu)	1880	846	696	136	81-330
Cadmium (Cd)	50	48	48	26	27-46

Note: Samples taken from surface waters (0-10 m) using Chelex extraction techniques for all metals except copper. Organic extraction was used for copper samples concentration in μg/hg.

Source: Kauner, Gordon and Martin, personal communication August 1979.

56 nautical miles west of Point Arguello in 2,000 fathoms and covers 1,125 square miles, and the other three sites are situated southwest of the Farallon Islands in 500, 850, and 1,200 fathoms of water, covering a total area in excess of 200 square miles. Of these low level radioactive sites only the Point Arguello site is located in the proposed sale area. In addition, two interim dredge spoil sites are located off Morro Bay (See Figure III.A.7-1). These interim dredge spoil sites were only used once (Belmer, 1983, personal communication).

Future dump sites may be designated as the need for disposal areas increases. In order for an area to be used as a dump site, a permit must be obtained from the EPA. This permit could be a general one, similar to the one issued for dumping mud and drill cuttings from platforms in the Santa Barbara Channel, or it could be site specific for a predetermined volume and type of material. Permitting helps maintain records of the type and location of materials dumped, and preserves the ecological balance in the area by choosing sites where the least damage is expected to occur.

8. Climate and Dispersion Meteorology: The climate of the Central California coastal area is marine in character with cool, dry summers and mild, wet winters. The area is primarily dominated by the North Pacific Subtropical High pressure system. The seasonal variation in the size, location, and intensity of this system accounts for the unique seasonal differences in weather patterns in the area. The Pacific High is most dominant in the summer when it is located to the west and north of California and reaches its greatest intensity and size. Thus dry, stable weather persists all summer. In the fall, the high pressure system weakens and gradually moves southward, thus allowing Pacific storm systems to reach the Coast. Periodic cloudiness and precipitation occur in winter as the high pressure system is weakest. Occasionally, the weather pattern is broken by a strong high pressure system over the continental U.S. causing warm, windy offshore flow conditions. This occurs primarily in fall and winter and causes the well-known Santa Ana winds in the more southern coastal areas.

Average annual precipitation ranges from 12 inches near Pt. Conception to about 48 inches in the Pt. Sur area. In the coastal areas, precipitation amounts are strongly dependent on nearby topography. Offshore precipitation tends to decrease with distance from the coast. The length of the rainy season increases from south to north. In general, rainfall occurs almost exclusively between November and April.

Average temperatures in January range in the 50s. In July, the average temperature ranges in the 60s. In the coastal areas, the diurnal temperature range is generally 15 to 20 degrees. Offshore diurnal temperature ranges are smaller.

Fog is most prevalent in summer due to the stable atmospheric conditions associated with a strong Pacific high pressure system and cold water upwelling near the coast. Table III.A.8-1 shows the frequency of visibility below certain threshold values in various OCS basins. The data were obtained from summarized shipboard observations (NOAA, 1980). The frequency of restricted visibility is lowest in the period of April through May, and is highest in the period of July through October. The frequency of visibility below 2 nautical miles (nm) is less than 7 percent in all basins in April.

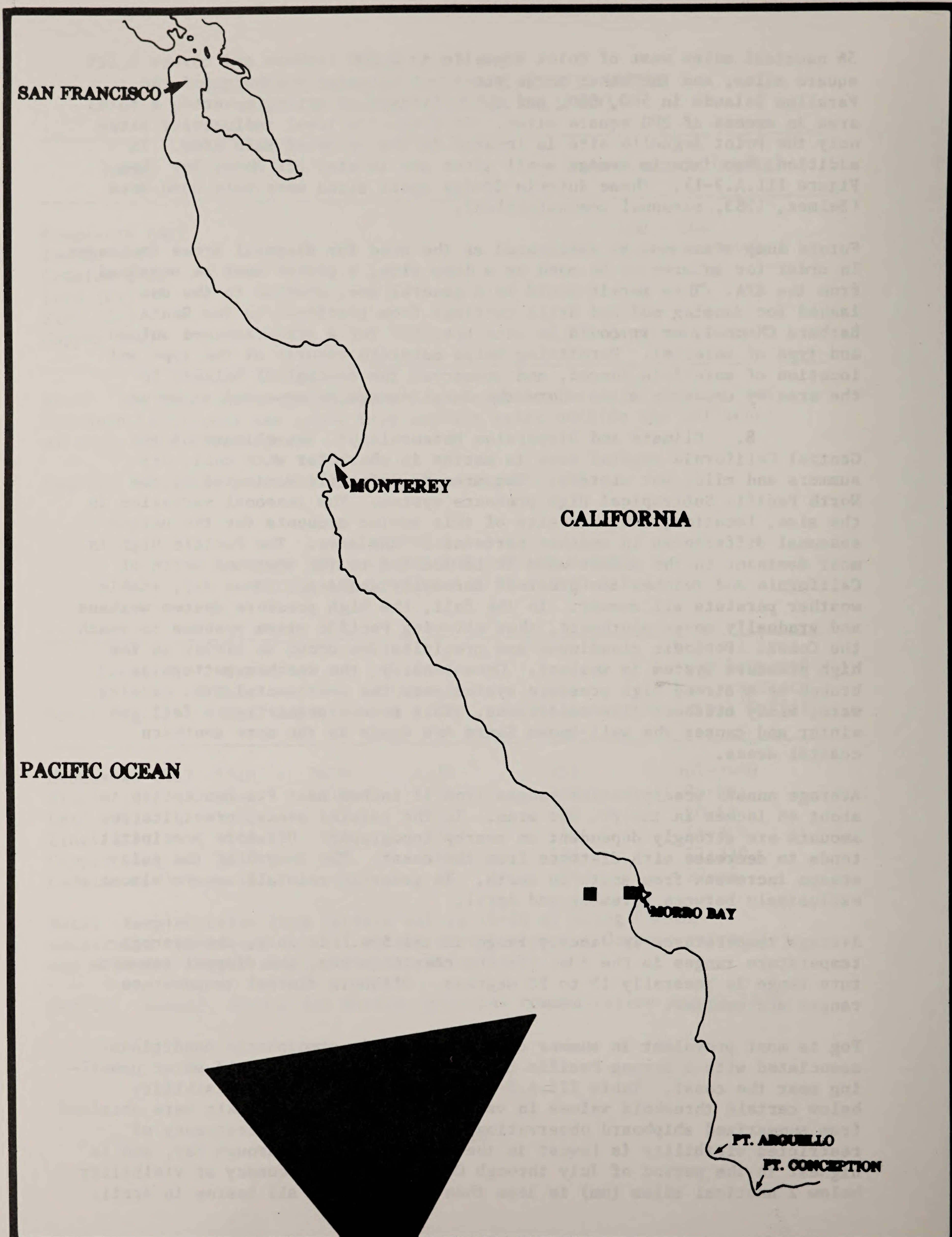


FIGURE III.A.7-1 DESIGNATED DUMP SITES OFF CENTRAL CALIFORNIA.

TABLE III.A.8-1

FREQUENCY OF VISIBILITY BELOW GIVEN THRESHOLD VALUES[1]

	Bodega Basin		Santa Cruz Basin		Santa Maria Basin	
	0.25 n.mi	2 n.mi	0.25 n.mi	2 n.mi	0.25 n.mi	2 n.mi
January	2-4	6-20	0-5	1-13	0-4	1-13
February	2-8	6-17	1-5	3-12	0-5	0-12
March	0-2	4-11	1-2	3-7	0-4	3-5
April	1-2	4-7	1-2	2-6	0-2	0-6
May	1-2	5-12	1-3	3-7	0-3	2-9
June	1-4	6-15	1-4	5-10	0-3	0-8
July	1-6	6-16	0-4	4-18	1-5	3-14
August	0-4	10-16	2-7	6-25	1-7	3-25
September	2-8	10-25	2-7	6-19	0-4	3-13
October	3-5	11-14	3-9	7-17	1-10	4-17
November	1-6	7-18	1-6	5-14	0-5	4-13
December	3-5	9-29	0-5	5-15	0-9	4-13

1. Frequency is percentage of total observations. The range of values is given for an area within about 100 n.mi from shore. Information extrapolated from data summary prepared by NOAA (NOAA, 1980).

This frequency increases over the succeeding months and reaches a maximum of 25 percent in portions of the Santa Cruz and Santa Maria basins in August. The frequency of visibility below 0.25 nm is less than 2 percent in all basins in April and May, but reaches a maximum of 10 percent in October in portions of the Santa Maria basin.

The prevailing wind over the Central California OCS is from northwesterly directions. Average wind speeds based on shipboard observations ranges from 6 to 19 knots (nautical miles per hour) (NOAA, 1980). Wind speeds tend to be highest during late spring and early summer.

MMS has deployed a network of buoys to study the wind characteristics of the California OCS areas (Aerocomp, 1982). The buoys in the Central California OCS areas are located between 10 and 20 miles from shore. The data based on the first year of observations show that for the months of April through October winds are almost predominantly from northwesterly directions. Average wind speeds from this direction ranged from 10 to 20 knots. Wind speeds for any other direction were considerably lower. For the months of November through March, winds are more variable, although the prevailing direction is still northwesterly.

Average wind speeds for the prevailing directions ranged from 6 to 10 knots. A comparison of wind data from the OCS buoys with data from onshore stations indicated that over the OCS the wind generally flows at a slight angle to the shoreline, while at coastal locations the wind tends to have a larger onshore component. This is to be expected because of the diurnal land-seabreeze influences as well as the effects of surface roughness over the land.

The seabreeze is almost a daily phenomenon along the California Coast, especially during the summer months. This assures onshore flow in the daytime, which is strongest in the afternoon. Weak offshore flow is often observed at night. The effect of land-seabreeze circulations on the transport of atmospheric pollutants in coastal areas was illustrated in a tracer study conducted in the Santa Barbara Channel (Reible and Shair, 1981). The prevailing winds, combined with the diurnal seabreeze, would cause pollutants from offshore sources to be transported onshore.

Temperature inversions exist along the California Coast persistently in the summer, and somewhat less frequently in the winter. A temperature inversion is a layer of air in which temperature increases with height. Within an inversion layer, atmospheric mixing is greatly restrained. Since these inversions along the California Coast are often low level (usually about 300 m or 1,000 feet), pollutants released close to the ground are trapped, leading to potential high concentrations of air contaminants. These inversion conditions, combined with prevailing onshore flow, create a potential air pollution problem for coastal areas located downwind of major emission sources. During summer, cold surface water along the coast, causes an inversion layer by cooling the atmosphere immediately above the ocean surface. This inversion layer moves onshore with the daily sea breeze. The inversion weakens as it moves further inland as the air below the inversion warms up. During the nighttime, strong cooling of the air near the ground causes inversions over land.

Atmospheric stability can be described in terms of the Pasquill Stability Index. Stability Index A indicates very unstable conditions with high potential for mixing, while Stability Index F is the most stable, indicating very limited mixing. Table III.A.8-2 shows the observed frequency distribution of atmospheric stability of various onshore stations (NOAA, 1980). These figures are indicative of coastal conditions, but not necessarily of offshore conditions. Over water, both very stable and very unstable conditions would tend to be less prevalent.

Tracer studies were conducted by BLM in the coastal area near Ventura to characterize overwater dispersion (Aerovironment, 1981). The results showed that vertical dispersion tended to be smaller over water than over land, whild horizontal dispersion tended to be larger over water than over land. Another tracer study has been conducted by MMS, Pacific OCS Region in the coastal area near Santa Maria. REsults of this study will be available early in 1983.

9. Air Quality: Air quality in a particular area depends upon the prevailing weather conditions, local topography, and proximity of sources of aur pollution. Pollutant levels are measured by sampling at selected locations. Routine air pollution monitoring efforts are primarily concentrated in large populated areas or in areas near major pollution sources. Thus, few air quality data exist along large sections of the coastlane.

Onshore emission sources are regulated by the local air pollution control agencies, the California Air Resources Board (CARB), and the Federal Environmental Protection Agency (EPA). Ambient air quality standards have been promulgated by the State and EPA which set maximum allowable air pollution concentrations to protect human health and welfare (Appendix G). The Clean Air Act, as amended in 1977, requires the State to prepare a State Implementation Plan (SIP) for those regions that do not meet the ambient air quality standard for any pollutant regulated. The SIP is a plan designed to bring future air pollution levels below standards.

Air emissions on the OCS are regulated by the U.S. Department of the Interior (DOI). These regulations establish a review process for offshore emission sources designed to prevent adverse efforts on onshore air quality (30 CFR 250.57). A brief overview of the regulations are given in Appendis H. A more detailed discussion is presented by Form and Substance, Inc. (1982).

Table III.A.9-1 summarizes current (1982) compliance status with respect to Federal ambient air quality standards for each Air Pollution Control District bordering the Central California OCS. The discussion of air quality in the following paragraphs is based on air quality monitoring performed in 1981 (CARB, 1981).

Ozone is the most common air pollutant in many Califonria coastal areas. Ozone results from photochemical reactions involving nitrogen oxides and hydrocarbons in the atmosphere, and primarily occurs in large urban areas. The Federal ambient standard for O_3 is 12 parts per hundred million (pphm) for the maximum 1-hour average. The corresponding California ambient standard is 10 pphm.

TABLE III.A.8-2

RELATIVE ANNUAL FREQUENCY OF ATMOSPHERIC STABILITY

	Pasquill Stability Index					
	A	B	C	D	E	F
Arcata	0.6	4.4	8.1	60.9	7.5	18.4
San Francisco	0.1	5.3	11.7	55.7	12.7	14.4
Vandenberg, AFB	0.7	7.2	11.9	22.8	26.7	30.7
Pt. Arguello	0.8	4.1	11.0	27.4	29.9	26.3

Source: NOAA, 1980. Frequency is in percentage of total observations.

TABLE III.A.9-1

CURRENT COMPLIANCE STATUS FOR MAJOR AIR POLLUTANTS

Region	Pollutant				
	O_3	TSP	NO_2	SO_2	CO
<u>North Central Coast Air Basin</u>					
Monterey County	P	A	A	U	A
Santa Cruz County	P	A	A	U	U
San Benito County	P	A	A	U	U
<u>South Central Coast Air Basin</u>					
San Luis Obispo County					
Salinas Valley Area	A	S	A	U	A
Other	A	A	A	U	A
Santa Barbara County (AQMA)	P	A	A	U	P
Santa Barbara County (non-AQMA)					
Western area	P	P	U	U	U
Eastern area	P	U	U	U	U
Ventura County					
Northern area	P[1]	U	A	A	A
Southern area	P	P	A	A	A
Channel Islands	U	U	U	U	U

A - Attainment, better than Federal air quality standards
P - Nonattainment, exceeds primary standards
S - Nonattainment, exceeds secondary standards
U - Unclassifiable, insufficient data exist to make a determination

Note:
1. Proposed for reclassification to Attainment.

SOURCE: 40 CFR 81.305

In the North Central Coast Air Basin the highest observed 1-hour O_3 concentration was 14 pphm at Holister. The highest concentration for a coastal monitoring site was 10 pphm and occurred at Scotts Valley.

The highest observed 1-hour O_3 level in San Luis Obispo County was 10 pphm at Morro Bay, Nipomo, and Paso Robles. These levels are below the Federal standards. However, the State standard was violated once at each of the above monitored sites. In Santa Barbara County, highest measured levels were 10 pphm at Santa Maria, 8 pphm at Lompoc, 11 pphm at Santa Ynez, 11 pphm at El Capitan Beach, 18 pphm at Goleta, and 24 pphm at Santa Barbara. In the coastal area adjacent to the Santa Barbara Channel, there is a definite increase in O_3 concentrations from west to east.

Measurements of TSP indicated violations of the 24-hour State standard at many locations in both Air Basins. Many monitoring stations in Santa Barbara County recorded violations of the Federal standard. Highest concentrations were measured at Santa Maria, where a maxium 24 hour average of 518 ug/m^3 was recorded.

Measurements of NO_2 did not show any violations of Federal or State ambient air quality standards. The California 1-hour average NO_2 standard is 470 ug/m^3. The maximum 1-hour average NO_2 concentration in the North Central Coast Air Basin was 240 ug/m^3 observed at Holister. In San Luis Obispo County the maximum 1-hour average NO_2 concentration was 220 ug/m^3 observed at San Luis Obispo.

Concentrations of SO_2 were below Federal and State air quality standards in both Air Basins. The highest observed 1-hour average concentration was 707 ug/m^3 at Nipomo in San Luis Obispo County. The California ambient standard is 1310 ug/m^3. The maximum 24-hour average SO_2 level at Nipomo was 99 ug/m^3. The Federal standard for 24-hour average SO_2 levels is 365 ug/m^3.

Measurements of CO exceeded were below ambient air quality standards at all monitoring locations. Any significant CO levels are confined primarily to large urbanized areas.

Noise. Most of the region, immediately onshore from the proposed lease blocks, are sparsely populated with little industry. At most shoreline locations the predominant sounds are associated with wind noise, ocean surf, and infrequent vehicular traffic. Depending upon wind and sea conditions, ambient noise levels at the shoreline typically range between 40 and 60 decibels (dBA*) and may approach 30 dBA during calm periods. Even though these sound levels are nearly the same as those experienced in suburban areas, many persons find "natural sounds" more esthetically pleasing than man-made sounds of the same level. Urban and industrial areas, by comparison, experience noise levels of approximately 70 dBA.

B. Biological Environment

1. Intertidal Benthos: Intertidal habitats are of two principal types, rocky and sandy. Gradations, such as unstable boulders and human

*dBA is defined as the A-weighted decibel level. It is a weighted average of sound levels across the range of frequencies sensed by the human ear.

constructed bulkheads, wharfs, breakwaters, etc., occur but most of the coast can be classified as either sandy or rocky.

The rocky shore intertidal substrate forms a stable platform to which macroalgae and invertebrates attach and obtain a firm hold against the force of waves. Among the cover/protection given by the larger attached (sessile) plants and animals, live a myriad of usually smaller invertebrates. Some attach to the larger basal organisms while others move among the community grazing on vegetation, others filter small planktonic particles from the water, while others are predators of other community members. During high tide, while the intertidal is covered with water, fish feed on the productive intertidal community.

Factors which influence the distribution, abundance, and species composition of rocky intertidal shores may be divided into two categories: 1) physical factors, and 2) biological factors. The more important physical factors include exposure and impact of waves, substrate composition, texture and slope of the substrate desiccation, water temperature, and light. The more important biological factors are competition and predation. Generally, the upper intertidal area contains some species which appear to be transitional between land and sea forms. These organisms can survive neither completely on land nor completely in the sea. The upper intertidal grades into the lower intertidal which has more and more species occupying more and more of the available space, until, somewhere around midlevel and below, every conceivable space is inhabited by algae or invertebrates. In general, the upper vertical limits of rocky shores are determined by physical conditions, while the lower vertical limits are controlled by the biological factors (Carefoot, 1977).

The environment of the exposed sandy intertidal is considerably less stable than that of the rocky intertidal. Every wave on a sandy intertidal beach moves large amounts of sand. Animals living on surf-swept rocky intertidal areas have solved the problem of wave shock by evolving powerful attachment devices or by living in cryptic habits. Organisms on surf-swept sandy beaches achieve the same solution by burrowing (burying) themselves in the sand. Nevertheless, sandy beaches have comparatively fewer organisms and species, and population level fluctuations are far greater.

The extent of rocky shores and sandy beaches is approximately equal (53% rocky and 47% sandy) in central-northern California. See BLM, 1980 Visual #5 for distribution of rocky and sandy beaches.

Rocky Intertidal. Scientific literature on rocky intertidal in central-northern California is spotty with a few areas, particularly the Pacific Grove area near Monterey, very well studied and the rest of the coast hardly studied at all. The Pacific Outer Continental Shelf Office of BLM has contracted Woodward and Clyde (1982) to conduct a helicopter general survey of the principal intertidal species to complement similar studies in Southern California by Littler (1979) and Littler and Littler, (1980).

Odemar, et al., (1968) described the coast from a geological perspective between Fort Ross and Point Lobos, and included a generalized description

of the rocky intertidal communities typical of a Central California area. An overview of the central-northern California coast is in the Summary of Knowledge papers written for BLM by Hancock (1977) and Hardy (1977). These list nearly all pertinent studies in the form of a partially annotated bibliography and can be supplemented by similar papers written for Southern California by Murray (1974), Bright (1974), BLM (1975) (1979). Papers depicting certain areas of the coast are also summarized in the EIS for Sale No. 53 (BLM, 1980) together with an overview of the intertidal communities of the Central and Northern California Coast.

The study area is within the Oregonian biogeographical province which begins at Pt. Conception and extends to Puget Sound, Washington or Prince William Sound, Canada depending on the author (Valentine, 1966). Literature on rocky intertidal species distribution indicates that the change in species composition in central-northern California is not major (Stephenson and Stephenson, 1972), (Woodward and Clyde, 1982).

Extensive intertidal sampling has been conducted at Government Pt., part of the Pt. Conception complex (Littler, 1978, 1980; Martz and Littler, 1979) and at Pt. Arguello (Chambers Consultants and Planners, 1980; Rodrique, et al., 1976 and Newswanger, in Chambers Consultants and Planners, 1980).

Around Pt. Conception, there are a number of species with a limited geographical range. Littler and Littler (1980) reported the most pronounced break between warm and cold water algae occurred at Government Pt. The species diversity at Government Point was the highest of all intensely studied of mainland sites in Southern California (Littler, 1980). At Point Arguello, approximately 19 km (12 mi.) north of Point Conception, Littler and Littler (1980) reported a unique dense population of intertidal black abalone which may serve as brood stock for much of the mainland coast of Southern California. Newswanger reported from preliminary analysis that the geographic range of 17 species of littoral molluscs ended at the Point Conception boathouse.

The Santa Barbara Channel in Southern California is known as an area containing many endemic species (BLM, 1979). Little has been written about endemic species north of Pt. Conception, largely because few investigations have been conducted in the area. However, it is assumed intertidal and shallow subtidal areas just north of Pt. Conception have some endemic species by virtue of their proximity to the division between major biogeographic provinces.

Woodward and Clyde (1982) reported from their general survey that the major dominant species and zonation of the rocky intertidal are essentially the same throughout central-northern California.

Identification of particular rocky intertidal areas more sensitive than the norm to oil spills, was identified from topographic and biological features. In identifying the sensitive rocky intertidal areas of Central California, our first assumption was that not all areas of the coast are equally sensitive to oil spills nor do they have the same ability to recover from catastrophes.

Other assumptions for identifying sensitive areas were as follows:

(1) The occurrence of flat rocky intertidal platforms. Spilled oil has a greater potential of becoming stranded on flat areas than sloped areas or sheer straight cliffs (Gundlach and Hayes, 1978).

(2) Isolation from other rocky intertidal areas. Should a catastrophe significantly decrease or obliterate an intertidal population or community, recovery which typically comes from drifting larvae or spores, will be retarded for those species. The distance between the harmed area and brood stock would be too far for extensive immediate settling.

(3) Extensive intertidal area along the shore without significant interruptions by sandy beaches, etc. A rocky intertidal area extending essentially uninterrupted for many miles was of less concern than a small area even if they both had broad flat intertidal platforms.

(4) Concern for areas by sources outside this office; such as Areas of Special Biological Significance.

(5) Intertidal biologists who have examined areas the coast were consulted for areas of unusual productivity, assemblages or species. Those consulted include:

Dr. Gordon L. Chan - College of Marin
Dr. Mark M. Littler - Smithsonian Institute
Dr. Stephen N. Murray - Cal State Irvine

Also consulted for areas north of Pt. Reyes were Dr. D. DeMartini and Dr. Milton J. Boyd of Humboldt University.

The areas based upon topographic features were seleted from 1) Woodward-Clyde videotape taken from a fixed-wing aircraft to identify the major areas for further examination, 2) Woodward-Clyde videotape taken from a slower low-flying helicopter to establish specific areas of concern, and 3) conformation of sensitive areas from an actual fixed-wing overflight.

The sensitive intertidal areas are shown in Table III.B.1-1.

Sandy Beaches. Because of the continued restructuring of sandy beaches, the number of individuals per species varies greatly from year to year. There is, however, a characteristic group of animals which live just below the low tide line or within the sand between the tide lines. A few organisms even live higher up on the beach in burrows or beneath organic debris. Additional general comments on sandy beach ecology are presented by Cubit (1969), MacGinitie and MacGinitie (1949), Ricketts et al., (1968), and Trask (1970).

Accounts dealing with sandy areas in central-northern California are few. Although Allen (1964) collected 20 species in Northern California, only the mole crab was collected every year (1958 to 1961); the other species were

TABLE III.B.1-1

SENSITIVE ROCKY INTERTIDAL AREAS OF CENTRAL CALIFORNIA BASED ON ISOLATION, FLAT PLATFORMS AND DISTANCE OF CONTINUOUS HABITAT WITHOUT SIGNIFICANT INTERRUPTION

(1) Point Reyes Headlands -
Very abundant floura and fauna, particularly dense mollusk populations

(2) Agate Beach and Duxbury Reef -
Largest flat intertidal reef in California with some isolation north and south from other rocky intertidal areas. Giant mussel populations.

(3) Farallon Islands -
Rocky area isolated from other rocky intertidal areas by approximately 15 miles.

(4) James Fitzgerald Marine Reserve through Piller Pt. -
Broad flat rocky platforms. Highly productive intertidal stretch of coast extending for 5 miles. Similar assemblages to Duxbury Reef.

(5) Ano Nuevo Island -
Extensive flat intertidal platforms.

(6) Monterey Peninsula -
Has 80% of known flora of the western coast of North America. Is a major biogeographic transition zone. High density of intertebrates, including mollusks. Summer fog prevents dessication to organisms at low tide. Historic scientific area. Includes areas semi-protected from large Pacific Waves (Pebble Beach. Flat intertidal platforms include:

a. Table Rock Area -
and

b. Needle Rock Pt. -

c. Pacific Grove Marine Gardens ASBS -
Important intertidal area; one of the best studied in the country, partly because of its great diversity of species and richness.

d. Cypris Pt. -
and

e. Pt. Pinos -
Along 17 Mile Drive, Monterey Peninsula, the two areas which stand out, having the broadest flat rocky platforms along a stretch of coast, and having a relatively continuous rocky intertidal with scattered flat platforms.

TABLE III.B.1-1 (Cont.)

(7) Carmel River State Beach to Soberanes Pt. (including Pt. Lobos Reserve) - Many deep coves giving a lot of surface area to intertidal habitats. Several semi-protected areas including Whaler's cove. Only rich population of intertidal macroalgea Eisenia in central-northern California (Pt. Lobos Reserve)

(8) Piedras Blancas Pt. Area - Flat intertidal platforms.

(9) Cayucos to San Simeon Beach
Very rich intertidal communities and diverse habitats, including intertidal pools, sea stacks, boulder beaches. Includes broad flat intertidal area at San Simeon Point which is somewhat isolated to the north and south by sand beaches and is very diverse in chitons and barnacles.

(10) North of Spooner Cove to Pt. San Louis
Numerous intertidal black abalone, limpets, chitons and mudbanks. Flat intertidal platforms, including a very extensive one just north of Spooner Cove which is isolated from other rocky intertidal areas to the north by large sandy beach (Morro Bay spit).

(11) Pirate's Cove Area - Fossil Pt. to Mallough Landing (Avila) - Numerous flat intertidal platforms. Numerous intertidal black abalone, chitons and mudbanks.

(12) Mussel Pt. to Pt. Sal -
Low flat intertidal platforms. Isolated north and south from other rocky intertidal areas by sandy beaches. Numerous intertidal black abalone, limpets, chitons and mudbanks.

(13) Packard Pt. to Purisimo Pt. off Vandenburg Air Force Base - Numerous flat platforms. Isolated north and south from other rocky intertidal areas by sandy beaches.

(14) Pt. Arguello to Cojo Pt. in Southern California, including Pt. Conception
Dividing line between major biological provinces and consisting of both northern (Oregonian) and southern (California) species.

absent or in low abundance at least one of the years studied. As few as 3 to 5 species were collected at a site, while the maximum collected per site was 18, far fewer than rocky intertidal areas.

Two species of recreational and economic importance, the razor clam Siliqua patula, typical of the northern regions, and the pismo clam Tivela stultorum, more common in Central California, should be mentioned as important members of this habitat.

Important sandy beach or clam areas reported by Woodward and Clyde (1982) and Gordon Chan and Stephen Murray (Personal Communication, 1982) include:

(1) Duxbury Reef Sand Flats
(2) Halfmoon Bay Harbor
(3) Monterey Bay beaches
(4) Atascadero State Beach
(5) Pismo Beach
(6) Pismo-Oceano Beach

2. Subtidal Benthos: The continental shelf of central-northern California is gradually sloping to the continental slope. Although it is periodically cut by canyons or interrupted by biologically important shallow banks or sea mounds, the shelf along central-northern California is a typical continental shelf in contrast to the atypical Sothern California continental shelf. The sediment of the central-northern California shelf generally grades from coarser sandy sediment in shallow water near shore to finer silt and clay substrates in the deeper waters near the outer margin. The benthic invertebrates similarly grade from filter or suspension feeders on sandy substrates to deposit feeders in finer sediments. Although little information is available on the bottom communities of the region, it is reasonable to assume that they are productive and diverse owing to the indirect evidence of abundant upwelling and high fisheries landings. The presence of endemic species is not well known, but is assumed to be less than in Southern California. Central California has important kelp forests which gradually decrease in Northern California.

The subtidal benthic communities and assemblages of Central California are not well known, although the Monterey Bay region may represent an exception to this rule. A comprehensive literature survey by Winzler and Kelly Consulting Engineers (1977) summarized previous benthic studies in the central-northern California region. Other studies of central-northern California subtidal benthic communities have been conducted and include Allen (1964), Hardy (1972, 1973), Johnson (1971) and Odemar, et al., (1968); however, most of these are relatively localized in scope and tend to focus on areas close to shore.

The greatest concern for offshore oil development on the subtidal benthos are hard bottoms and topographic highs, such as seamounds, reefs, etc., although largely unexplored, most of these topographic highs may have rocky outcrops and are usually areas of heavy fish concentration.

The locations of known rocky outcrops are shown on Graphic No. 2. Additional outcrops will be identified as geological surveys using closer spaced grid patterns are conducted. Several topographic highs are outside the sale area. The largest bank that is at least partly within the sale area is Santa Luca Bank off Santa Maria.

Kelp. Kelp farm forests which serve as habitats for other algae and a myriad of invertebrates that attach to the kelp, feed on the kelp, live in the protection of the holdfasts of the kelp, or are otherwise attracted to the forests. Fish are attracted to kelp forests primarily for protection and food. Two seaweeds, Macrocystis and Nereocystis, form kelp forests in California and have overlapping forest-forming ranges in Central California.

The giant kelp or Macrocystis, identified by having many floats (pneumatocysts), is distributed from Sitka, Alaska to Pt. Abrevjas, Baja California, but does not form extensive forests north of Pt. Ano Nuevo. DeMartini, however (personal communication) reports small forest type patches of Macrocystis as far north as Mendocino County. The bull kelp or Nereocystis, having a single float from which originate numerous lamina or blades, is distributed from Alaska to Santa Barbara, but forms forests only north of Pt. Conception (Smith, 1969; Bell and Ally, 1972).

Two significant life history differences exist between the two kelp species. Nereocystis is an annual, and the forest formed by this species is almost completely replaced every year. In Central California, at least at Diablo Cove, Nereocystis essentially lives for 2 years (Burge and Schultz, 1973).

Macrocystis is a perennial and the individual plants of the forests tend to remain for periods of over a year, up to 6 years (North, 1971).

Anderson and North (1966) have found that, despite an extremely high rate of sporulation, the successful recruitment of Macrocystis sporophytes decreases exponentially with distance from the parent plant and is essentially limited to an area within 5 m of the parent. That is, young plants are only found very close to the parent plant. This contrasts with the dispersibility of other benthic organisms which have spores or larvae that drift for miles before settling. This has resulted in speculation that drifting plants, rather than spores, may serve as an important means of propagating the species.

Since Nereocystis as well as many other brown algae have similar life histories and dispersal mechanisms, a mass mortality of kelp or other brown algae species in a defined area may result in very slow recovery because of the limited dispersal mechanism resources.

3. Fish Resources: The marine environment offshore central-northern California is rich in fish life. Of the 562 species of coastal marine fishes known to occur offshore California, about 500 are found in central-northern California waters (Miller and Lea, 1972, 1976; Winzler and Kelly, 1977). These counts do not include all of the deep-sea fishes, so the total number of fish species offshore central-northern California probably exceeds 500.

The fish offshore California occur in three main regions: 1) epipelagic, 2) deep-sea, and 3) benthic. While these designations are useful, the regions overlap. The fish species most vulnerable to impacts from offshore oil and gas activities in each of these regions are discussed below. Estuaries (see Section III.B.7) and kelp beds (see Section III.B.2) also are important fish habitats.

Epipelagic Fishes. The epipelagic zone consists of roughly the upper 150-200 meters (492-656 feet) of the ocean. In this vast region that covers about 71 percent of the earth's surface live some of the smallest (e.g., anchovies) and largest (e.g., tunas) fishes.

The northern anchovy (Engraulis mordax), a pelagic schooling fish, is one of the most abundant species in the region. Their extremely large numbers make them important consumers of smaller marine organisms as well as food for larger fishes.

The range of the anchovy is from Baja California to British Columbia but they are most abundant south of San Francisco. Anchovies are found mostly within 100 miles of the coast. North of San Francisco, spawning occurs primarily in the summer. South of San Francisco, spawning occurs primarily in winter and spring near shore. In summer and fall months, large compact schools are found during daylight hours along submarine escarpments and canyons at depths of 110-183 meters (360-600 feet). The schools rise to the surface at night and disperse. As the night passes, they tend to school more tightly until dawn, when they return to the deeper waters. These behavior patterns are similar to some extent throughout the year and may be influenced by water temperature, availability of food, spawning condition, and amount of ambient light at night. In spring, many small schools are found at the surface during the day while the fish tend to scatter over a wide area at night. From April to June, extremely large dense surface schools, containing up to several hundred tons, form during daylight hours and disperse or move into deeper water at night. These schools are usually found within 37 km (20 nautical miles) of the coast (Frey, 1971). Anchovies reach reproductive maturity in 1-2 years and generally live 3-4 years unless harvested.

The Pacific herring (Clupea harengus) is a pelagic schooling fish that ranges from San Diego to the Bering Sea and occurs offshore Japan. These fishes may be found from tidewater, where they spawn, to at least 120 miles at sea. The major herring populations in California waters are from stocks that spawn in San Francisco Bay and Tomales Bay. Humboldt Bay, Monterey Bay, most estuaries, and some open coast areas have small spawning runs. Spawning occurs during fall, winter, and spring. Eggs are deposited on seaweed, pilings, and anything projecting above the bottom. Adults return to the ocean immediately after spawning. Most larvae move out of the estuary soon after hatching. Herring reach sexual maturity in 3-5 years and generally live to 9 years in California waters.

Some of the most important recreational and commercial species of fish using the overlying waters of the continental shelf off the coast of California are anadromous forms such as salmon, trout, shad, and striped bass.

Such fish begin their life in freshwater, use the estuarine environments as juveniles, either to feed or merely as a passage to the open ocean, and then feed as immature adult fish in either estuaries or in the open ocean until sexual maturity. On attaining sexual maturity, they return to freshwater or to the highly dilute upper areas of estuaries to spawn. Some forms invariably die after spawning (Pacific salmon-genus Oncorhynchus; candle fish or eulachon--genus Thaleichthys). Some have a high mortality associated with spawning (anadromous trouts--genus Salmo), while others can return to the sea in large numbers after spawning under natural conditions (striped bass- Roccus saxatilis; American shad--Alosa sapidissima; and the sturgeons--family Acipenseridae). (Striped bass and American shad were successfully introduced into California waters from the east coast of the United States.)

Since Pacific salmon die after spawning, successful spawning is very important to survival of these populations. These fish often return to their river of origin to spawn. King salmon (Oncorhynchus tshawytscha) generally spawn in larger river systems north of San Francisco such as the Klamath, Eel, Smith, and Sacramento. Silver salmon (O. Kisutch) spawn in many small streams and rivers north of Monterey, but the most important California streams are the Klamath, Eel, and Smith. Most king salmon enter spawning streams in the "fall" (late summer to early fall) or in the "spring" (spring to early summer). Most silver salmon enter spawning streams in fall and early winter. Downstream migration of king salmon usually occurs during the first few months of life whereas downstream migration of silver salmon usually doesn't occur until salmon are more than a year old. King salmon reach sexual maturity in 3-4 years and silver salmon reach maturity in 2-3 years.

Another species that is abundent in this region is the opalescent or market squid (Loligo opalescens). Squid are not fish but are included in this section since they are active swimmers. The opalescent squid ranges from British Columbia to central Baja California and may occur in the Gulf of California. Although during most of their life squid are widely distributed offshore, squid congregate inshore in very large numbers during spawning. Spawning occurs in about January of February in Southern California and about April in the Monterey Bay area. Monterey Bay and the Santa Barbara Islands are the most important spawning areas but large spawning aggregations are also known to occur along the coast from Monterey to San Diego. Squid live 1-2 years and die after one spawning season.

Other important fishes in the epipelagic zone include albacore, lingcod, sharks, jack mackerel, Pacific saury, and Pacific hake. Information on these resources and further information on the resources discussed above are presented in Winzler and Kelly (1977).

Deep-sea Fishes. The deep-sea zone consists of roughly the region from 200 meters (656 feet) to 4,000 meters (13,123 feet). The zone is inhabited by vast numbers of small (less than 0.3 meters long), black or dark fish that have silvery reflective sides and frequently have luminescent organs. Members of the families Myctophidae (lanternfish), Bathylagidae, and Gonostomidae are the most abundant deep-sea fishes offshore California.

Most deep-sea fishes inhabit surface waters as larvae. Here small planktonic forms provide food in what is probably a less demanding place to grow. As they mature, the fishes, now equipped to face the rigors of midwater existence, undergo a downward migration.

Although at least part of the lives of deep-sea fishes is spent in waters several hundred to thousands of meters deep, many deep-sea fishes undergo periodic vertical migrations and, therefore, may be found in the upper 100-500 meter layer of the ocean.

Although none of the deep-sea fishes are large, their extremely large numbers make them important consumers of smaller marine organisms as well as food for larger fishes.

Benthic Fishes. The benthic region includes the bottom of the ocean at all depths. Many commercially and recreationally important species reside in this region.

One of the most prominent benthic fish groups is flatfish. Important flatfish species include:

-Dover sole	*Microstomus pacificus*;
-English sole	*Parophrys vetulus*;
-Petrale sole	*Eopsetta jordani*;
-Rex sole	*Glyptocephalus zachirus*;
-Starry flounder	*Platichthys stellatus*;
-Pacific sanddab	*Citharichthys sordidus*;
-California halibut	*Paralichthys californicus*

All flatfish range from Southern California (or Baja California) to Canada or Alaska, except the California halibut which does not occur north of Washington. Information on the life histories of flatfish is provided in Table III.B.3-1.

Other important benthic fishes include rockfish, sablefish and poachers. Information on these fishes is presented in Winzler and Kelly (1977).

4. Marine Mammals: The information on marine mammal distribution and abundance in central-northern California is excerpted from the second year report on the study being performed for MMS by the Center for Coastal Marine Studies, University of Santa Cruz, hereafter designated the CCMS (1982). Data were obtained primarily from aerial surveys. Details of the methods are found in the report.

Cetaceans. More than 22 species of cetaceans (whales, porpoises and dolphins) are known to occur in central-northern California waters. See Table III.B.4-1 for a list of species.

The following information is excerpted from the chapter on cetaceans (Dohl, et al., in CCMS, (1982)).

Cetaceans were found in all months and in all parts of the study area. Use varies along some portions of the coastline.

TABLE III.B.3-1

FLATFISH LIFE HISTORY CHARACTERISTICS

Species	Depth Range (meters)	Where Spawning Occurs (meters)	Spawning Period	Age at Sexual Maturity (years)	Maximum Age (years)
Dover Sole	37-1463 (120-4800 ft)	≧549 (≧1800 ft) Offshore Pt. St. George, Eureka, Pt. Delgado, Bodega Head and Pigeon Pt.	Nov-Mar	8-9	25
English Sole	18-274 (60-900 ft)	9-165 (30-540 ft) North of Eureka, off San Francisco, Monterey Bay, and Santa Barbara Channel	Nov-Mar	5	18
Petrale sole	37-457 (120-1500 ft)	274-411 (900-1350 ft) Offshore Eureka, Pt. Delgado, Pt. Arena, Pigeon Pt., and Pt. Sal	Nov-Mar	4-5	25
Rex sole	37-457 (120-1500 ft)	55-91 (180-300 ft)	Jan-June	3	24
Starry flounder	0-165 (0-540 ft)	Uncertain	Nov-Feb	2-3	10
Pacific sanddab	18-110 (60-360 ft)	Unavailable	July-Sept	6-8	13
California halibut	0-46 (0-150 ft)	5-18 (18-60 ft)	Feb-July	2-6	Unavailable

Sources: Pacific Fishery Management Council (1982), Winzler and Kelly (1977), and Frey (1971).

TABLE III.B.4-1

CETACEANS KNOWN TO OCCUR IN CENTRAL AND NORTHERN CALIFORNIA WATERS
IN ORDER OF OBSERVED FREQUENCY WITHIN THE BALEEN AND TOOTHED WHALE GROUPS

Common Name	Scientific Name
BALEEN WHALES	
***California gray whale	Eschirichtius robustus
***humpback whale	Megaptera novaeangliae
***blue whale	Balaenoptera musculus
***fin whale	Balaenoptera physalus
minke whale	Balaenoptera acutorostrata
*sei whale	Balaenoptera borealis
***right whale	Eubalaena glacialis
TOOTHED WHALES	
Pacific white-sided dolphin, lag	Lagenorhynchus obliquidens
northern right whale dolphin, lisso	Lissodelphis borealis
Risso's dolphin, grampus	Grampus griseus
Dall's porpoise	Phocoenoides dalli
harbor porpoise	Phocoena phocoena
killer whale	Orcinus orca
***sperm whale	Physeter catodon
pilot whale	Globicephala scammoni
Cuvier's beaked whale	Ziphius cavirostris
**pygmy sperm whale	Kogia breviceps
**dwarf sperm whale	Kogia simus
Stejneger's beaked whale	Mesoplodon stejnegeri
Hubb's beaked whale	Mesoplodon carlhubbsi
ginko-toothed whale	Mesoplodon ginkgodens
dense-beaked whale	Mesoplodon densirostris
Baird's beaked whale	Berardius bairdi
**false killer whale	Pseudorca crassidens
*common dolphin	Delphinus delphis
**Pacific bottlenose dolphin	Tursiops gilli
spotted dolphin (porpoise)	Stenella attenuata
spinner porpoise	Stenella longirostris
**streaker porpoise, striped dolphin	Stenella coeruleoalba

*Observed only once in two years
**Not observed during the first two years of the Santa Cruz
***Animal is on the Federal list of endangered species

The major segregation is by way of water depth, with 70 percent of the animals seen over the continental slope. A stratification of the study area from the shoreline seaward into three realms (0-99 fm, 100-999 fm, and 1,000 fm and greater) produces some significant distributional information.

	0-99 fm	100-999 fm	1,000 fm+
Percentage of sightings:	47.2	36.5	16.3
Percentage of animals:	6.1	69.5	24.4
Percent of study effort:	18.2	32.6	49.2

The high sighting percentage, coupled with the extremely modest percentage of animals found in the nearshore realm of 0-99 fm, reflects the pod composition of the animals found. Solitary gray whales and numerous small groups of harbor porpoises constitute the majority of nearshore sightings. In contrast, the mid-water realm of 100-999 fm (covering the continental slope) is favored by the majority of species that aggregate into large schools. The Pacific white-sided dolphin, grampus, and northern right whale dolphin are examples of this type of cetacean. School size in the nearshore waters averaged approximately 3 animals, while over the slope the groupings exceeded 69 animals each.

Seasonal and geographical distributions can be roughly summarized as follows:

(1) Winter finds the highest densities and greatest use statewide.

(2) Summer has the lowest densities and sparsest use statewide.

(3) Autumn is the season when cetacean schools coalesce into larger aggregations.

(4) In all seasons the southern one-third of the study area central-northern California carries more animals, more individual schools and larger schools than the remainder of the study area.

Gray whale migration routes are shown in Figure III.B.4-1. Distribution and abundance of gray whales along the central-northern California coast were described in CCMS (1982) as follows:

> The earliest sightings of the southern migration occurred on 6 November with only a few animals; the main body arrived off the central California coast in late December. The majority of the southbound animals were observed within 2 nm of shore, with 6% of the sightings located 5 nm or more offshore. The greatest distance southern-migrating gray whales were seen offshore was 46 nm, due west of the town of Mendocino.
>
> Once again the northern migration was observed in two pulses or fronts. The initial movement comprised the bulk of the returning population, with the second and smaller pulse being fundamentally mother/young pairs. As in the past, the northern migration occurred closer to the shoreline than the southern. The mother/young sightings occurred extremely close inshore, frequently within the kelp beds or directly seaward of the breaker line. Less than 2% of the northbound whales were sighted greater than 5 nm offshore, with the maximum distance being one sighting of 11 animals 43 nm west of the Big Sur coastline.

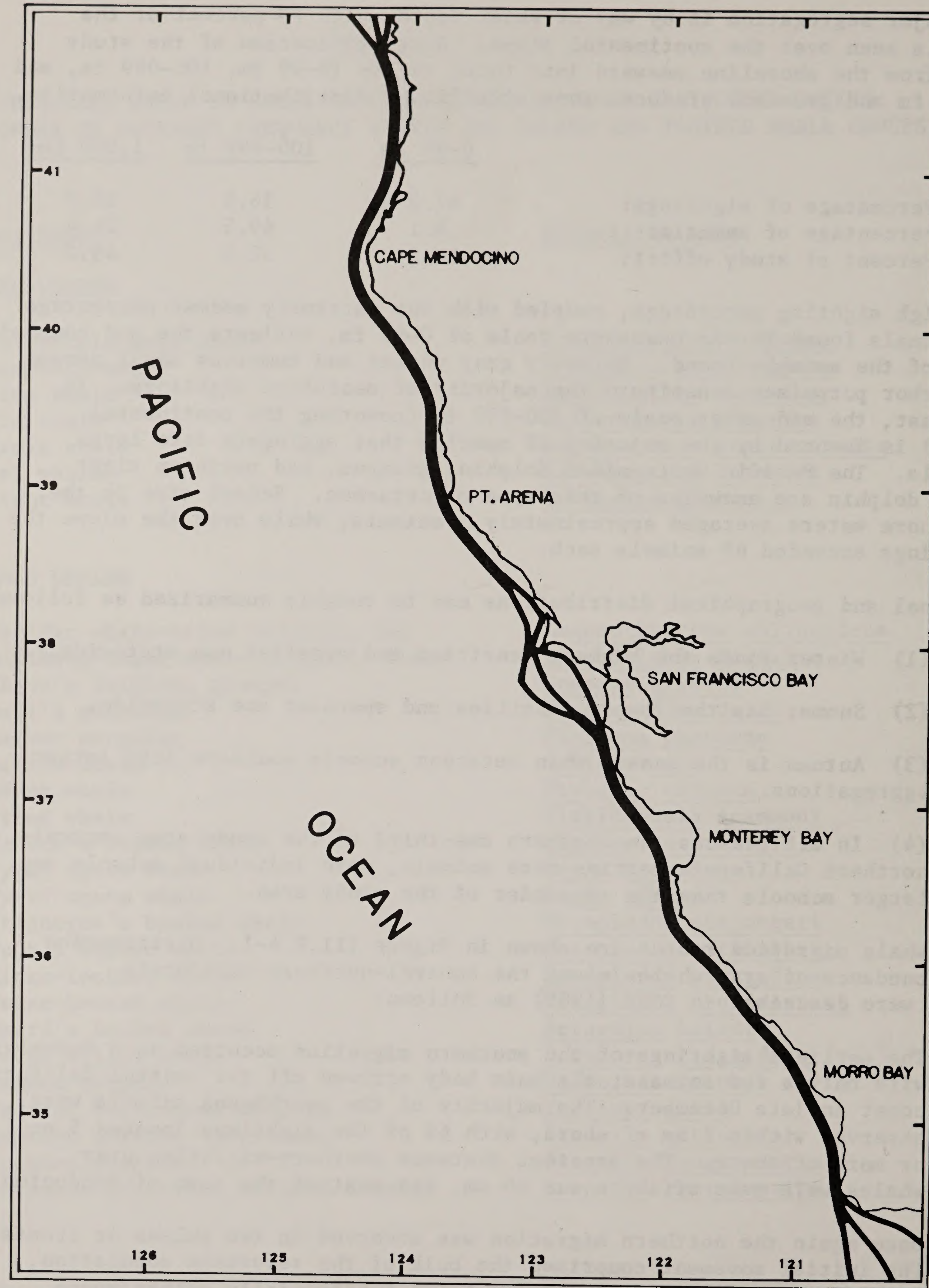


FIGURE III.B.4-1. GRAY WHALE MIGRATORY ROUTE PATHWAYS. FIGURE FROM CENTER FOR COASTAL MARINE STUDIES, 1982.

Excluded from the offshore computations are those sightings from Bodega Head, Gulf of the Farallones, Monterey Bay, and San Luis Obispo Bay. Animals in these areas are frequently found several miles from the coastline due to headland-to-headland traverses.

These observations are thought to reasonably represent the present migratory routes.

Pinnipeds. The following is excerpted from the pinniped section of the Center for Coastal Marine Studies Report (Pierson, et al., in CCMS, (1982)).

Five species of seals and sea lions use the resources of the central-northern California coast. Each has its season of peak abundance in the area and its characteristic annual cycle. The two most abundant species, the northern fur seal (Mirounga angustirostris) and California sea lion (Zalophus californianus), reach peak numbers during their migrations. In contrast, harbor seals (Phoca vitulina) and Steller sea lions (Eumetopias jubatus) reach peak numbers during their breeding seasons, and northern elephant seals (Mirounga angustirostris) reach peak abundance on land during their molting season.

Northern fur seals and northern elephant seals spend much of the year at sea, drifting alone or in small groups in the pelagic waters of the California Current. California sea lions, Steller sea lions, and harbor seals, on the other hand, are frequently found on land, and routinely commute from onshore hauling grounds to offshore feeding grounds.

Three of these species breed in central-northern California. Northern elephant seals breed in the winter, from December to early March. Rookeries exist at present on Ano Nuevo Island and on Southeast Farallon Island, and, beginning in 1981, at Cape San Martin on the Big Sur coast. Harbor seals pup and breed in the spring, from late March to June. Pups are born at many locations along the coast, but protected bays and estuaries, such as Humboldt Bay and Drake's Estero, seem to be preferred as rookery sites. Steller sea lions breed in the late spring and early summer, from May to July. Although a few pups are born each year on the St. George Reef and, probably, at other locations on the north coast as well, the major California Steller sea lion rookeries are on Ano Nuevo Island, Sugarloaf Rock at Cape Mendocino and, on a smaller scale, Southeast Farallon Island.

Counts of pinnipeds on land are always underestimates of total population size, since an unknown segment of the population is at sea. Nevertheless, censuses do indicate those areas that are important to the animals at various times of the year. Figure III.B.4-2 summarizes hauling out season in central-northern California. Haul out areas vary with the species and the season. See Section IV.E.2.d for pupping seasons. Figure III.B.4-3 summarizes the season distribution of pinnipeds at sea over two years, 1980 and 1981. For more details on the individual species and seasonal aspects, see CCMS (1982).

Sea Otters. The Santa Cruz study was not designed to study sea otter distributions. Aerial surveys of this sort are probably not the best means for censusing sea otters. However, these data are the only ones available at this time. The following is excerpted from the section on sea otters in the Center for Coastal Marine Studies Report (CCMS, 1982).

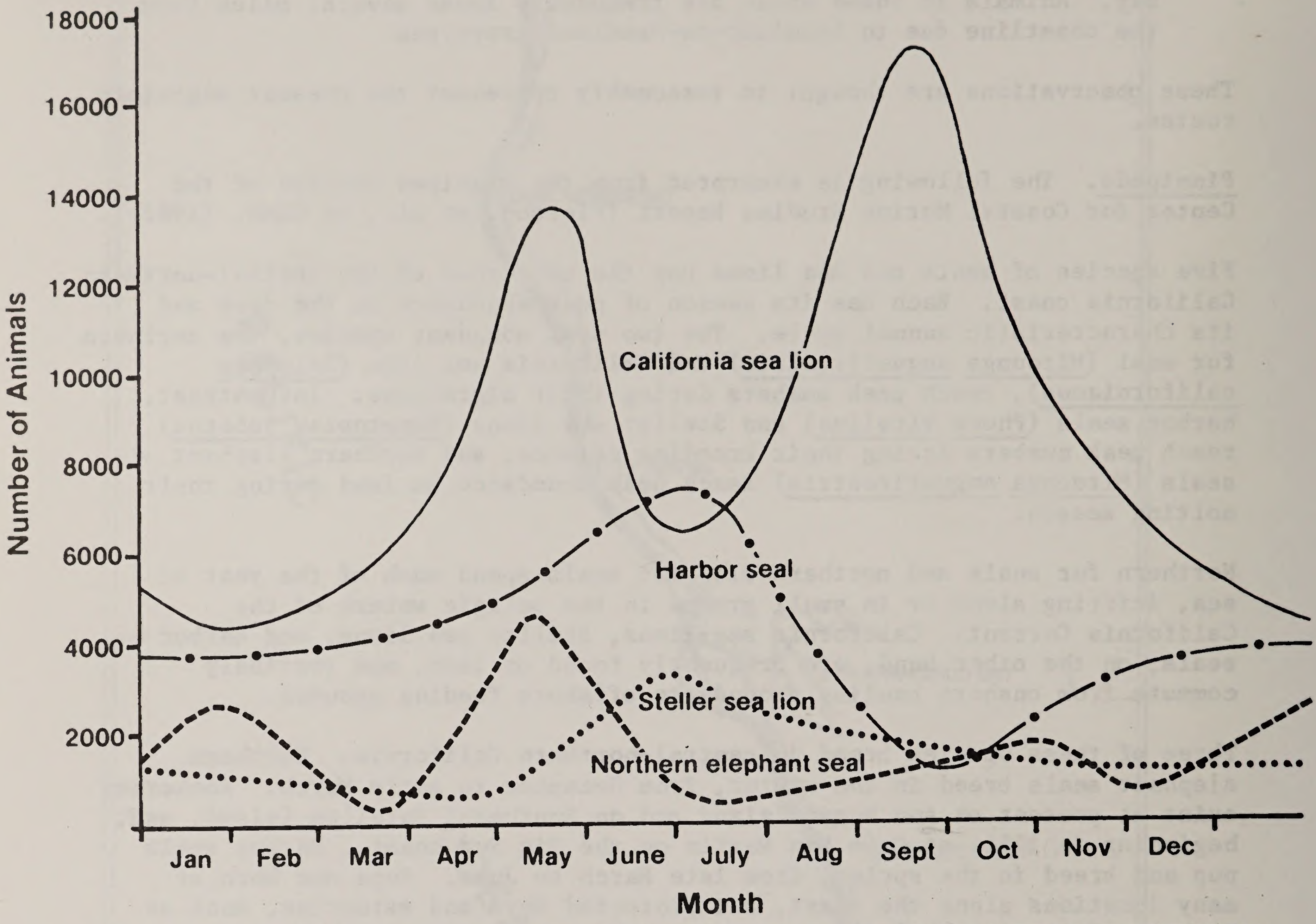


FIGURE III.B.4-2 ANNUAL CYCLE OF PINNIPEDS ON LAND IN CENTRAL-NORTHERN CALIFORNIA (BASED ON DATA COLLECTED FEBRUARY 1980 THROUGH JANUARY 1982). FIGURE FROM CENTER FOR COASTAL MARINE STUDIES, 1982.

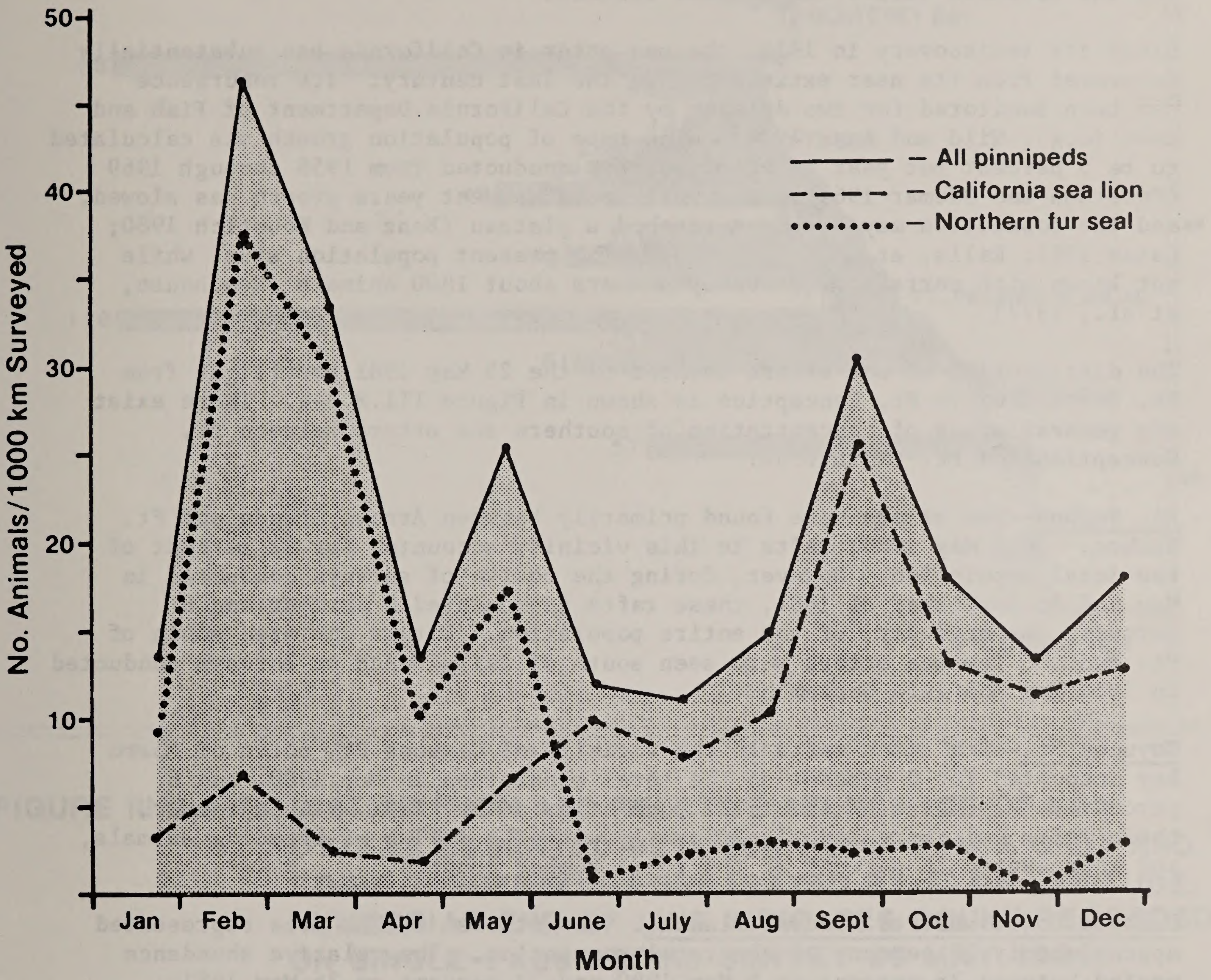


FIGURE III.B.4-3. MEAN RELATIVE OBSERVED ABUNDANCE OF PINNIPEDS SIGHTED AT SEA (NO. ANIMALS/1000 KM OF TRANSECT LINE SURVEYED), FEBRUARY 1980 THROUGH JANUARY 1982. FIGURE FROM CENTER FOR COASTAL MARINE STUDIES, 1982.

Southern Sea Otter. The southern sea otter, *Enhydra lutris*, is found in coastal kelp forest habitat from Pt. Buchon near Morro Bay to Soquel Cove in Monterey Bay. Small groups are occasionally seen as far north as Ano Nuevo Pt. and as far south as Pt. Sal. Wanderers from this population have been recorded as far north as Cape Mendocino, and as far south as Pt. Mugu and the Southern California Channel Islands.

Since its rediscovery in 1938, the sea otter in California has substantially recovered from its near extirpation in the last century. Its resurgence has been monitored for two decades by the California Department of Fish and Game (e.g., Wild and Ames 1974). The rate of population growth was calculated to be 5 percent per year based on surveys conducted from 1958 through 1969 (Peterson and Odemar 1969). However, in subsequent years growth has slowed, and the population may now have reached a plateau (Benz and Kobetich 1980; Estes 1981; Ralls, et al., in press). The present population size, while not known with certainty, probably numbers about 1800 animals (Woodhouse, et al., 1977).

The distribution of sea otters counted on the 25 May 1981 overflight from Pt. Santa Cruz to Pt. Conception is shown in Figure III.B.4-4. There exist six general areas of concentration of southern sea otters between Pt. Conception and Pt. Santa Cruz:

Pt. Buchon--Sea otters were found primarily between Arroyo Grande and Pt. Buchon. On 5 May 1980, rafts in this vicinity accounted for 11 percent of the total population. However, during the course of surveys conducted in May and in September of 1981, these rafts represented 8 percent and 6 percent, respectively, of the entire population. Within the area south of Pt. Buchon, few sea otters were seen south of Avila Beach on surveys conducted in late May and late September.

Cayucos Pt.--Sea otter rafts in the vicinity of Cayucos Pt. north of Morro Bay accounted for 8 percent of the total population in May 1980, and 6 percent to 7 percent of the total population in May 1981. In September, these rafts had increased significantly with the influx of breeding animals, and represented 16 percent of the total number counted.

Cambria Coast and Pt. Piedras Blancas. Sea otters in this area represented approximately 25 percent of the total population. The relative abundance varied between 26 percent on 5 May 1980 and 23 percent on 25 May 1981. However, on 19 May 1981, rafts in this area represented only 14 percent of the total, as many animals moved northward toward Cape San Martin (see below).

Cape San Martin to Pt. Sur. This area in the middle of the sea otter range held 28 percent to 33 percent of the total population. Rafts were relatively small, but numerous throughout the area. Most animals were found in the vicinity of Cape San Martin, Gamboa Pt., and Pfeiffer Pt. The distribution of animals seen on surveys conducted in May 1981 suggest that there is considerable movement of animals within this area. The pattern of these relocations is unclear, but presumably related to the exploitation of food resources. On 19 May 1981, approximately two-thirds of the total number counted in this area were found south of Cape San Martin. Six days later,

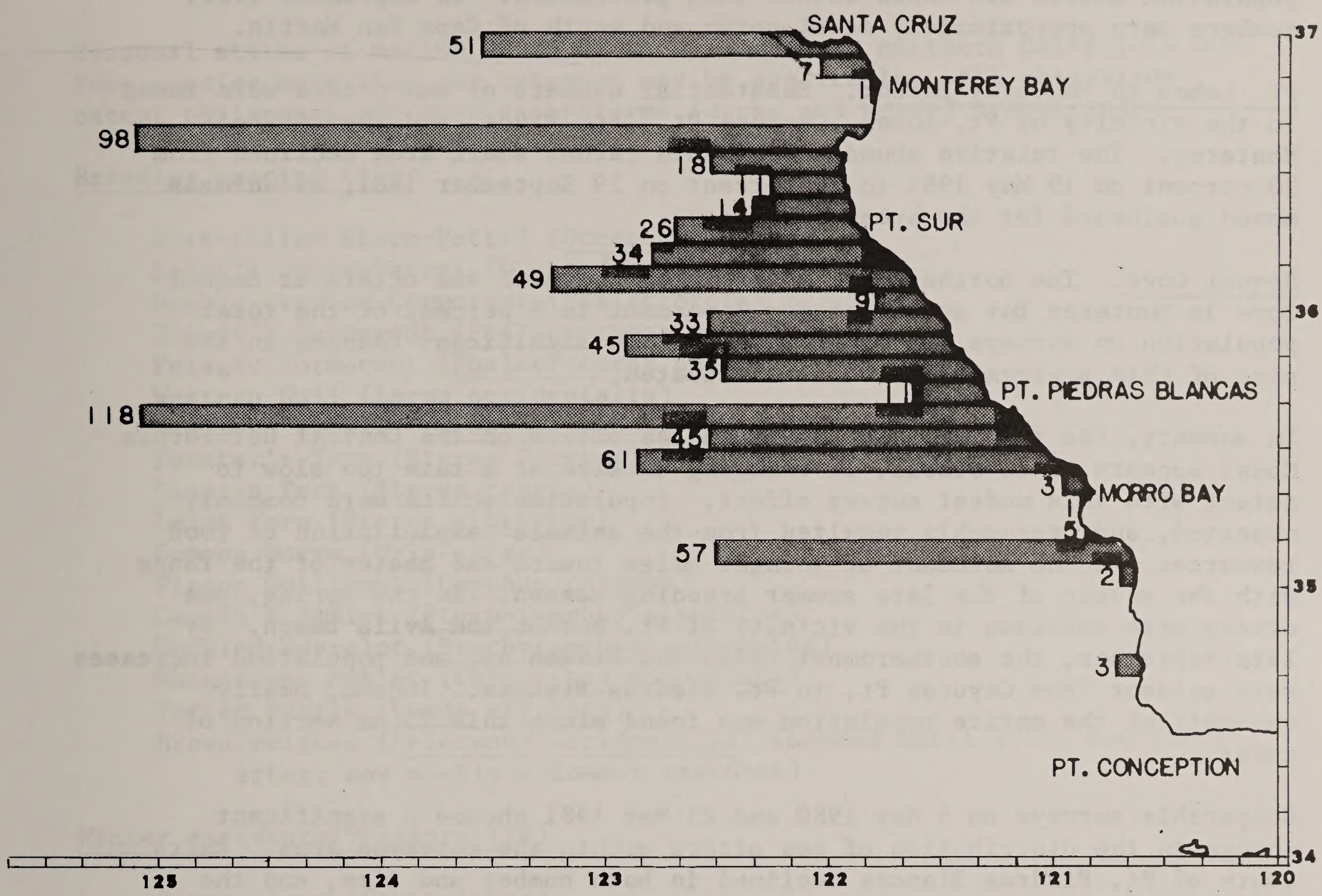


FIGURE III.B.4-4. DISTRIBUTION AND RELATIVE ABUNDANCE OF SEA OTTERS OBSERVED BETWEEN POINT SANTA CRUZ AND POINT CONCEPTION, AGGRAGATED BY 5' OF LATITUDE. NUMBER AT END OF LINE INDICATES COUNT RECORDED ON SINGLE-PASS AERIAL SURVEY 25 MAY 1981. FROM CENTER FOR COASTAL MARINE STUDIES, 1982.

on 25 May 1981, this distribution had reversed, with two-thirds of the total being counted north of Cape San Martin. This suggests that the time-course for relocations on the order of 10 nm is short; that is, population shifts are rapid rather than protracted. In September 1981, numbers were approximately equal north and south of Cape San Martin.

Pt. Lobos to Monterey Harbor. Substantial numbers of sea otters were found in the vicinity of Pt. Lobos, Cypress Pt., Pt. Pinos, and the city of Monterey. The relative abundance in this rather small area declined from 30 percent on 19 May 1981 to 16 percent on 29 September 1981, as animals moved southward for the breeding season.

Soquel Cove. The northernmost established rafts of sea otters at Soquel Cove in Monterey Bay accounted for 7 percent to 8 percent of the total population on surveys conducted in 1981. No significant changes in the size of this aggregation have been detected.

In summary, the population of southern sea otters on the Central California Coast appears to be stable, or changing in size at a rate too slow to detect with this modest survey effort. Population shifts were commonly observed, and presumably resulted from the animals' exploitation of food resources and the movement of younger males toward the center of the range with the advent of the late summer breeding season. In the spring, sea otters were numerous in the vicinity of Pt. Buchon and Avila Beach. By late September, the southernmost rafts had broken up, and population increases were evident from Cayucos Pt. to Pt. Piedras Blancas. Indeed, nearly one-half of the entire population was found along this 25 nm section of coast.

Comparable surveys on 5 May 1980 and 25 May 1981 showed a significant change in the distribution of sea otters within the surveyed area. Rafts south of Pt. Piedras Blancas declined in both number and size, and the occupation of the stretch of coast from Pt. Sur to Monterey increased proportionally. There is insufficient data available at this time to predict whether this distribution will persist in subsequent years. A detailed listing of sea otter sitings can be found in CCMS (1982).

5. Seabirds: The following information on seabird distribution and abundance for central-northern California is excerpted from the Seabird section (Briggs, et al., in CCMS 1982) of the second year report on the study being performed for MMS by the Center for Coastal Marine Studies, University of Santa Cruz, hereafter designated the CCMS (1982) Report.

The marine bird fauna of the study area (central-northern California) comprises 93 species dominated both in numbers and in biomass by species that are common throughout the eastern North Pacific from Southern California to the Gulf of Alaska. Seventeeen species nest within the study area, comprising an aggregate of ±700,000 individuals (Sowls, et al., 1980) (Table III.B.5-1). The most numerous among these are Common Murres, Cassin's Auklets, Brandt's Cormorants, and Western Gulls; all but the gulls also nest in large numbers north of California. Most of the winter residents/ visitors and the spring/autumn migrants nest north of California. In contrast, the study area (Central California in particular) is visited during summer by eight species that nest in the southern hemisphere or in Mexico. These species sometimes exceed 1.0 million individuals in combined numbers.

TABLE III.B.5-1

SEABIRDS FROM CENTER FOR COASTAL MARINE STUDIES (1982)

Seasonal status of marine birds of the central and northern California OCS. Some species more than one category may be applicable. All shorebirds except phalaropes and most anseriforms (ducks and geese) are excluded.

Breeding species (17)

- Fork-tailed Storm-Petrel (Oceanodroma furcata)
- Leach's Storm-Petrel (Oceanodroma leucorhoa)
- Double-crested Cormorant (Phalacrocorax auritus)
- Brandt's Cormorant (Phalacrocorax penicillatus)
- Pelagic Cormorant (Phalacrocorax pelagicus)
- Western Gull (Larus occidentalis)
- Heermann's Gull (Larus heermanni)
- Forster's Tern (Sterna forsteri)
- Caspian Tern (Sterna caspia)
- Least Tern (Sterna albifrons)
- Common Murre (Uria aalge)
- Pigeon Guillemot (Cepphus columba)
- Cassin's Auklet (Ptychoramphus aleuticus)
- Marbled Murrelet (Brachyramphus marmoratus)
- Rhinoceros Auklet (Cerorhinca monocerata)
- Tufted Puffin (Lunda cirrhata)
- Brown Pelican (Pelecanus occidentalis) (nested until 1959, not thereafter; now mostly a summer resident)

Winter residents/visitors (26)

- Common Loon (Gavia immer)
- Arctic Loon (Gavia arctica)
- Red-throated Loon (Gavia stellata)
- Western Grebe (Aechmophorus occidentalis)
- Red-necked Grebe (Podiceps grisegena)
- Eared Grebe (Podiceps nigricollis)
- Horned Grebe (Podiceps auritus)
- Laysan Albatross (Diomedea immutabilis)
- Northern Fulmar (Fulmarus glacialis)
- Short-tailed Shearwater (Puffinus tenuirostris)
- White Pelican (Pelecanus erythrorynchos)
- Surf Scoter (Melanitta perspicillata)
- White-winged Scoter (Melanitta deglandi)
- Black Scoter (Melanitta nigra)
- Red-breasted Merganser (Mergus serrator)
- Harlequin Duck (Histrionicus histrionicus)
- Oldsquaw (Clangula hyemalis)
- Glaucous Gull (Larus hyperboreus)
- Glaucous-winged Gull (Larus glaucescens)
- Herring Gull (Larus argentatus)

Thayer's Gull (Larus thayeri)
California Gull (Larus californicus)
Ring-billed Gull (Larus delawarensis)
Mew Gull (Larus canus)
Black-legged Kittiwake (Rissa tridactyla)
Ancient Murrelet (Synthliboramphus antiquus)

Spring/autumn migrants (16)

Flesh-footed Shearwater (Puffinus carneipes)
Buller's (New Zealand) Shearwater (Puffinus bulleri)
Mottled Petrel (Pterodroma inexpectata)
Brant (Branta bernicla)
Red Phalarope (Phalaropus fulicarius)
Northern Phalarope (Lobipes lobatus)
South Polar Skua (Catharacta maccormicki)
Pomarine Jaeger (Stercorarius pomarinus)
Parasitic Jaeger (Stercorarius parasiticus)
Long-tailed Jaeger (Stercorarius longicaudus)
Bonaparte's Gull (Larus philadelphia)
Laughing Gull (Larus atricilla)
Sabine's Gull (Xema sabini)
Arctic Tern (Stern paradisaea)
Common Tern (Sterna hirundo)
Horned Puffin (Fratercula corniculata)

Summer/autumn (nonbreeding) residents/visitors (8)

Black-footed Albatross (Diomedea nigripes)
Pink-footed Shearwater (Puffinus creatopus)
Sooty Shearwater (Puffinus griseus)
Manx Shearwater (Puffinus puffinus)
Black Storm-Petrel (Oceanodroma melania)
Royal Tern (Sterna maxima)
Elegant Tern (Sterna elegans)
Xantus' Murrelet (Endomychura hypoleuca)

During both 1980 and 1981, most seabirds were seen over continental shelf (0-200 m) and slope 200 to 2,000 m) waters; they were concentrated in three areas where the shelf is most broad. These areas--Pt. St. George to Cape Mendocino, Bodega Head to Pt. Pinos, and Pt. Piedras Blancas to Pt. Conception--are separated from one another by sections of narrower shelf with correspondingly lower bird populations.

The predominant shoreline species censused were gulls, from October through mid-spring, murres and other nesting species during spring and summer, and cormorants and pelicans from midsummer into mid-autumn. Total shoreline populations were always higher from Bodega to Pt. Pinos than elsewhere. Details pertaining to these patterns are found in the discussions of species groups in Briggs, et al., CCMS (1982).

Sensitive nesting areas are tabulated in Section IV.E.2.e. See also Sale 53 Visual #7 (BLM, 1980) for seabird distribution.

6. Endangered and Threatened Species: Table III.B.6-1 lists and locates the Federally listed endangered or threatened species which <u>may be affected</u> by the proposed sale. This list is not inclusive of other endangered, threatened, or proposed endangered or threatened species known to occur in or near coastal areas of California (see Federal Register Vol. 45, No. 77, May 20, 1980) but for which it has been determined that no effects will be sustained as a result of the proposed sale. Such determinations were made as part of formal and informal consultation of BLM with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in compliance with Section 7 of the Endangered Species Act of 1973, as amended for Lease Sale 53.

The distribution of whales and sea otters is further discussed in Section III.B.4. Impacts to endangered species are discussed in Sections IV.E.2.d, e, and f.

7. Estuaries and Wetlands: Treatment of estuaries and coastal wetlands is divided into a general discussion of the habitats and a listing and characterization of estuaries and coastal wetlands found in central-northern California.

<u>General Characteristics of Estuaries</u>. Estuaries are bodies of water, ranging in size from streams through large bays, which communicate with the sea through usually constricted openings. The openings of many estuaries are closed to the sea for certain periods of time. Most estuaries have salinity gradients, being nearly freshwater near the head, where a freshwater stream typically enters, and close to seawater near the entrance into the sea at the mouth.

Estuaries themselves are highly productive and important habitats for full time residents and transient species. The species belong to nearly every major plant and animal taxonomic group. Many birds are dependent upon the highly productive bays for all or part of their life cycles. Some vegetation such as Cordgrass (<u>Spartina</u> <u>sp.</u>), pickleweed (<u>Salicornia</u> <u>sp.</u>) and eel grass (<u>Zostera</u> <u>sp.</u>), occur almost exclusively in estuaries and form salt marshes

TABLE III.B.6-1

FEDERALLY LISTED ENDANGERED OR THREATENED SPECIES MOST LIKELY TO BE AFFECTED BY THE PROPOSED SALE[1]

Species	California Distribution	Status[2]
Birds:		
American Peregrine Falcon (Falco peregrinus anatum)	Territories along coastal Calif. Between Oregon and Mexico	Endangered
Southern Bald Eagle (Haliaeetus leucocephalus)	Mainly in interior Calif. Some found along the coast and on Santa Catalina Island	Endangered
California Brown Pelican (Pelecanus occidentalis californicus)	Statewide along coast. Breeding only on Anacapa Island and Scorpion Rock in So. Calif.	Endangered
California Least Tern (Sterna albifrons browni)	San Francisco Bay to Mexico (Breeding) Major Colonies in San Diego County and Venice Beach	Endangered
California Clapper Rail (Rallus longirostris obsoletus)	Salt marshes of San Francisco Bay, San Pablo Bay, Napa Marsh and Elkhorn Slough	Endangered
Mammals:		
Blue Whale (Balaenoptera musculus)	Offshore	Endangered
Fin Whale (Balaenoptera physalus)	Offshore	Endangered
Gray Whale (Eschrichtius robustus)	Offshore	Endangered
Humpback Whale (Megaptera novaeanglinae)	Offshore	Endangered
Pacific Right Whale (Eubalena glacialis japonica)	Offshore	Endangered
Sei Whale (Balaenoptera borealis)	Offshore	Endangered

TABLE III.B.6-1 (Cont.)

Species	California Distribution	Status[2]
Sperm Whale (Physeter catadon)	Offshore	Endangered
Southern Sea Otter (Enhydra lutris nereis)	Soquel Cove south to Santa Maria River	Threatened
Reptiles:		
Leather-backed Turtle (Dermochelys coriacea Sechlegeli)	Rare visitors Tropical and sub-tropical seas of west coast; some stray as far north as Vancouver Is., British Columbia	Endangered
Loggerhead Sea Turtle (Caretta caretta)	Rare visitors Offshore	Threatened
Green Sea Turtle (Chelonia mydas)	Rare visitors Offshore	Endangered
Pacific Ridley	Rare visitors Offshore	Endangered

[1]As determined through consultation with U.S. Fish and Wildlife Service and National Marine Fisheries Service in compliance with Section 7 of the Endangered Species Act of 1973, as amended for Lease Sale 53.

[2]Per Federal Register, 20 May 1980, Vol. 45, No. 97.

and eel grass beds, which are some of the most productive habitats known in nature. The mud flats are rich in invertebrates, including clams, which are important to sportsfishermen. Fish and mobile invertebrates occur in the channels as well as over mud flats. Estuaries are also very important to the continental shelf ecology in Central California, serving as spawning or nursery grounds for marine fish and invertebrates, habitat for many oceanic birds, and as suppliers of nutrients to the near shore environment.

Estuary habitats can be divided into the six categories shown in Table III.B.7-1. The table summaries the detailed treatment of these habitats reported by Jones and Stokes (1980) and also summarized in the OCS Sale No. 53 EIS (BLM, 1980). No two estuaries are exactly alike and many smaller stream estuaries do not have every habitat listed in the Table, particularly eel grass beds. The areas in hectares occupied by the major habitats within the larger estuaries are shown in Table III.B.7-2.

The importance of small, non-living organic matter (detritus) in the flow of energy through the food chain is relatively more important in estuaries than it is in the open ocean. Primary productivity by plants is important in both systems, but detritus in estuaries is so important, estuaries have been said to have a detrital food chain (Darnell, 1961). Detritus is formed in all the habitats listed in Table III.B.7-1, but a surplus amount is formed in the eel grass and salt marsh habitats allowing surplus detritus to be exported to other habitats of the estuary and near shore oceanic areas consequently allowing them to become enriched in food matter. Since salt marshes and eel grass beds, under prolonged exposure (Baker, 1971a), are highly susceptible to oil spills, their consideration in a description of the affected environment becomes important.

<u>Important Estuaries of Central California</u>. Important references concerning estuaries of Central California are the Summary of Knowledge report by Winzler and Kelly (1977), and the characterization report by Jones and Stokes (1980). Estuaries are also covered by U.S. Department of the Interior (1978a, 1979, 1980). Individual estuaries have been given detailed coverage by California Fish and Game (CFG) as part of their wetland series as follows:

Balinas Lagoon (1970)
Elkhorn Slough (1972)
Morro Bay (1974a)

Estuaries of ecological concern in Central California are presented in Table III.B.7-2. Estuaries are important ecologically, as they may serve as bird feeding areas, marine fish nursery grounds, and anadromous fish spawning routes. Table III.B.7-3 gives the estimated width of opening of these estuaries. Criteria for the inclusion of estuaries on this table were major anadromous fish streams (California Fish & Game, 1973) and the Jones and Stokes (1980) tables labeled Areas of Ecological Concern (Volume IV Watersheds and Basins).

An estimation of entrance widths of important estuaries is shown in Table III.B.7-3. The "normal" entrance width was obtained from the openings as

TABLE III.B.7-1

ESTUARY HABITAT TYPES, THEIR PRINCIPAL TYPES OF ORGANISMS, AND COMMUNITY ENERGY RELATIONSHIPS

Habitat Type	Principal Tidal Type	Principal Species Type	Primary Production	Detrital Export/Import to Other Habitat Types
Open Water/ Channels	Subtidal	Plankton and swimming (pelagic) fish	Plankton	Imports more than it supplies other habitats
Rocky Bottom	Intertidal, but both occur especially near entrance	Attached algae and invertebrates	Attached algae	Exports more than it receives from other habitats
Mud Flat	Intertidal	Invertebrates (worms, clams) living within mud	Import surface diatoms	Imports more than it supplies other habitats
Sand Flat	Intertidal	Invertebrates living in the sand and on it (snails)	Import surface diatoms	Imports more than it supplies other habitats
Eel Grass Beds	Subtidal	Eelgrass; herbivorous invertebrates (snails); attached filter feeding invertebrates	Eelgrass	Exports more than it receives from other habitats
Salt Marsh	Intertidal	Salt marsh plants (cordgrass & pickle-weed), terrestrial and marine animals	Salt marsh plants	Exports more than it receives from other habitats; most important exporter in estuary

TABLE III.B.7-2

ESTUARIES OF ECOLOGICAL CONCERN IN CENTRAL CALIFORNIA

Estuary	Opening to Sea	Bird Feeding Area (+)	Important Marine Fish Nursery Grounds (I)	Important Anadromous Fish Spawning Route
Drakes Estero/ Limantour Estero	Open year round	+	+	+(minor)
Bolinas Lagoon	Open year round	+	+	+(minor)
Rodeo Lagoon	Intermittently open	+	-	+(minor)
San Francisco Bay Complex	Open year round	+	+	+
San Gregorio Creek	Intermittently open	+	-	+(minor)
Pescadero Creek	Intermittently open	+	+	+
Gazos Creek	Intermittently open (open most of year)	+	-	+ (steelhead)
Scott Creek	Intermittently open	+	-	+(minor)
Baldwin Creek Ponds	Intermittently open	+	-	+(minor)
Corcoran Lagoon/ Moran Lake	Intermittently open	+	-	+(minor)
Wilder Creek Pond	Intermittently open	+	-	+
San Lorenzo River	Open year round	+	-	+
Watsonville Slough/Pajaro River	Open year round	+	-	+
Elkhorn Slough Complex	Open year round constant width maintained by jetties	+	+	-

TABLE III.B.7-2 (Cont.)

ESTUARIES OF ECOLOGICAL CONCERN IN CENTRAL CALIFORNIA

Estuary	Opening to Sea	Bird Feeding Area (+)	Important Marine Fish Nursery Grounds (I)	Important Anadromous Fish Spawning Route
Salinas River	Intermittently open	+	-(minor)	-
Carmel River	Intermittently open	+	+	+
Little Sur River	Intermittently open	+	+	+ (steelhead)
Big Sur River	Intermittently open	+	+	+ (steelhead)
Morro Bay	Open year round constant width maintained by jetties	+	+	-
Santa Maria River	Intermittently open	+	-	-
Santa Ynez River	Intermittently open	+	-	-

TABLE III.B.7-3

WIDTH OF ENTRANCE AND AREAL DIMENSIONS OF MAJOR HABITATS OF THE IMPORTANT ESTUARIES IN CENTRAL CALIFORNIA
(All numbers are metric - meters and hectares)

	WIDTH OF ENTRANCE		Areal Dimensions of Important Habitat Types					
ESTUARY	NORMAL	MAXIMUM-MIN.	SALT MARSH	MUD FLAT	SAND FLAT	EEL GRASS	OPEN WATER CHANNELS	OTHER
Drakes-Limantour Estero								
Drakes	340[d]	110[d]-<340m[d]						
Limantour	130[d]	4250 -<130m[d]	81	235			522[b]	
Combined	400-110[d]	4850[d]-<400m						
Bolinas Lagoon (narrow) (wide)	100[d]- 300	3600 -<100[d] (Beachead)	61	292			150[b]	
San Francisco Bay (Pt. Bonita - Land's End)[d]	3600m	-	1296	16848[b]				
(Golden Gate)	1600m							
San Pablo-Suisun Bays								
S.P.							10449	20218[b]
Suisun								(salt ponds)
San Gregorio Creek	45[d]	200 - <45[d]						
(Pescadero Cr. - Butano Cr.) Pescadero Marsh	100m[d]	240 - 0[d]	20				30[a]	
Laguna Creek	0[d]	200 - 0[d] (Beachead)						
Baldwin Creek	0[d]	200 - 0[d] (Beachead)						
Wilder Creek Pond	0[d]	150 - 0[d] (Beachead)						
San Lorenzo River	75-100[d]	90 - 75[d]	1[b]				14[b]	
Woods Lagoon	100[d]	100-<100[d]						

TABLE III.B.7-3 (Cont.)

WIDTH OF ENTRANCE AND AREAL DIMENSIONS OF MAJOR HABITATS OF THE IMPORTANT ESTUARIES IN CENTRAL CALIFORNIA
(All numbers are metric - meters and hectares)

ESTUARY	WIDTH OF ENTRANCE NORMAL	WIDTH OF ENTRANCE MAXIMUM-MIN.	Areal Dimensions of Important Habitat Types: SALT MARSH	MUD FLAT	SAND FLAT	EEL GRASS	OPEN WATER CHANNELS	OTHER
Schwans Lagoon	10[d]	50 - 10[d]						
Cocoran Lagoon/ Moran Lake	C.L. 10 M.L. 10	80 - 10[d] 50 - 10	6.5[b]				4.5[b]	
Pajaro River/Watsonville Sl. (narrow) (wide)	300-[d] 450	450 - <300[d]	19[b]				32[b]	
Elkhorn Slough (inner) (outer exit to complex)	100[d] 150	120 - <100[d] 150 - 150	583[b]	170[b]			218	77[b,c] (salt ponds)
Moro Coho Slough	80[d]	80 - 80[d]						
Salinas River (at tide gate)	90[d]	90 - 0[d]						
McClusky Slough	0[d] (drainage into Pajaro R. Delta)	100 - 0[d]	22[b]				8[b]	
Carmel River	5-10[d]	100 - 5[d]	15[b]				1.6[b]	
Little Sur River	5-10[d]	100 - 5[d]						
Big Sur River	30[d]	150 - <30[d]						
Morro Bay	200[d]	200 - <200[d]	233[a]	567[b]			263[b]	
San Luis Obispo Creek (narrow) (wide)	30-[d] 100	100 - <30[d]	2.4[b]				9[b]	
Santa Maria River	3-5[d]	5 - 0[d]	20[b]				6[a]	

TABLE III.B.7-3 (Cont.)

WIDTH OF ENTRANCE AND AREAL DIMENSIONS OF MAJOR HABITATS OF THE IMPORTANT ESTUARIES IN CENTRAL CALIFORNIA
(All numbers are metric - meters and hectares)

	WIDTH OF ENTRANCE		Areal Dimensions of Important Habitat Types					
ESTUARY	NORMAL	MAXIMUM-MIN.	SALT MARSH	MUD FLAT	SAND FLAT	EEL GRASS	OPEN WATER CHANNELS	OTHER
Santa Ynez R.	0[d]	175 - 0[d]	44.5[b] 10.1				20[b] 23[a]	

a Central-Northern California characterization for BLM-USFWLS by Stokes and Jones (1980) Draft.
b California Fish and Game (1973) Coastal County Resources.
c California Fish & Game Wetland Study Series - see reference.
d USGS 7-1/2" Quad Maps.
e BLM Field Observations.
f California Dept. of Navigation and Ocean Development (1980) - Assessment and Atlas of Shoreline Erosion.
g Johnson (1972) Tidal Inlets of the California, Oregon and Washington Coasts.

TABLE III.B.7-4

TOTAL AREA OF MAJOR HABITAT

	Salt Marsh	Tidal Flats*	Open Water
San Francisco Bay	1,396	16,848	--
South of San Francisco	966	737	607

*Mud and sand flats combined.

mapped on U.S. Geological Survey 7 1/2' quad maps. Maximum openings, obtained from the same source, were estimated based on two assumptions. 1) the entire fronting spit bar may be breached (or washed away) during winter and spring flood conditions coupled with high tide and storms; 2) the entire valley at the mouth may be flooded and open when the entrance lies within a definite valley closely bordered by topographic highs. The former assumption is valid and is typical while the latter rarely occurs, perhaps only occurring during extremely rainy years within several of the estuaries. Therefore, these represent extremely conservative estimates of the maximum flooding possible. The minimum openings and the dimensions of major habitats were obtained from California Fish & Game (1973), Stokes and Jones (1980), Johnson (1972), the State Dept. of Navigation & Ocean Development (1977), California Fish & Game Wetland Series, Fish & Game personnel (personal communication) or BLM on-site observations. Estuaries were included in the table if they had major habitat areal extent included in California Fish & Game (1973) or appeared to have definite communication with the ocean on the Geological Survey maps.

Data such as these have many limitations and the table represents a rough approximation of the opening widths and areal extent of the major habitats. Nevertheless, despite its altered condition the relative ecological importance of the San Francisco Bay system is obvious. Table III.B.7-4 shows the total area of major habitat for the areas indicated in hectares.

Of the habitats listed south of San Francisco Bay, over 90 percent occur in Elkhorn Slough and Morrow Bay. The difference in bay openings is discussed in Section IV.E.2.g (Estuaries impacts).

8. Areas of Special Concern: There are three types of designated areas of special concern which are of biological importance. They are: 1) ecological reserves, 2) marine life refuges, and 3) area(s) of special biological significance (ASBS). These are legally defined and controlled by the State of California. Ecological reserves and marine life refuges are very similar; however, there are more restrictions and controls in an ecological reserve. The purpose of the refuges and reserves is to reduce the abuse and waste of the State's tidepool resources by restricting general collecting of all animals living in tide pools and other areas between the high tide mark and 1,000 feet below the low tide mark. Additionally, the California Sea Otter Marine Life Refuge in Central California was established to protect the sea otter population throughout its range in California. ASBS are also designed to protect intertidal and shallow subtidal areas. They are areas containing biological communities of such extraordinary, even though unquantifiable, value that no acceptable risk of change in their environments as a result of man's activities can be entertained.

From Tomales Bay to Pt. Conception, there are 9 ecological reserves, 3 marine life refuges and 15 areas of special biological significance (ASBS). The ASBS of Central California are listed in Figure III.B.8-1. The ASBS of Central California together with Southern California ASBS most vulnerable to impacts from this sale are shown in Table III.B.8-1.

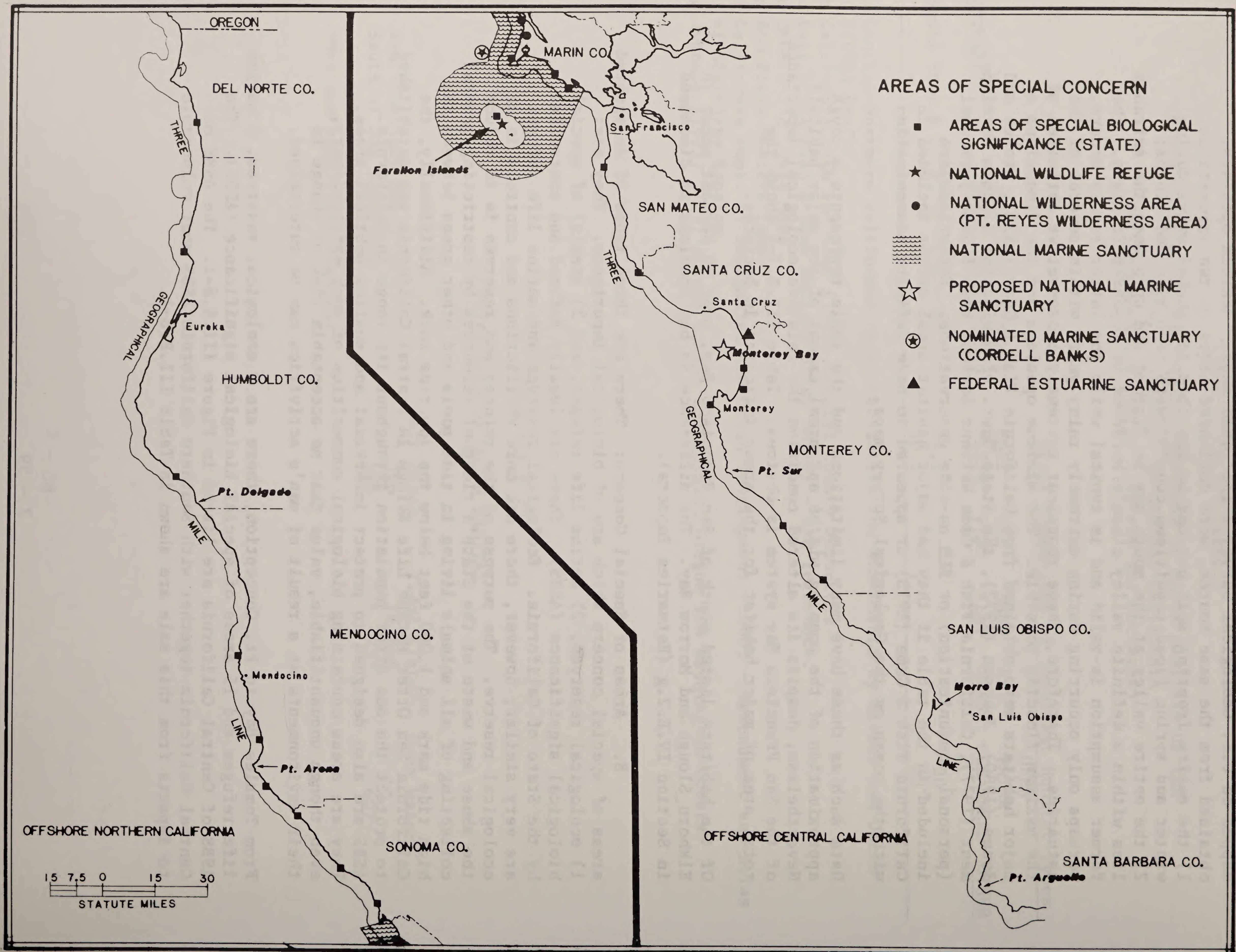


FIGURE III.B.8-1. AREAS OF SPECIAL CONCERN AND MARINE SANCTUARIES

TABLE III.B.8-1

AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE (ASBS) IN CENTRAL CALIFORNIA

1. Del Mar Landing Ecological Reserve
2. Gerstle Cove
3. Ocean Area Surrounding the Mouth of Salmon Creek
4. Bodega Marine Life Refuge
5. Farallon Island
6. Pt. Reyes Headland Reserve
7. Bird Rock
8. Double Point
9. Duxbury Reef Reserve
10. James V. Fitzgerald Marine Reserve
11. Ano Nuevo Pt. and Island
12. Pacific Grove Marine Gardens Fish Refuge and Hopkins Marine Life
13. Carmel Bay
14. Pt. Lobos Ecological Reserve
15. Julia Pfeiffer Burns Underwater Park

ASBS Most Likely Affected by Sale No. 73 in Southern California

San Miguel, Santa Rosa, and Santa Cruz Islands
San Nicolas Island and Begg Rock
Santa Barbara Island, Santa Barbara County and Anacapa Island
Mugu Lagoon to Latigo Pt.
Santa Catalina Island - Subarea One, Isthmus Cove to Catalina Head
Santa Catalina Island - Subarêa Two, North End of Little Harbor to Ben Weston Pt.
Santa Catalina Island - Subarea Three, Farnsworth Bank Ecological Reserve
Santa Catalina Island - Subarea Four, Binnacle Rock to Jewfish Pt.

9. Point Reyes/Marine Sactuaries: The wilderness area, extending from the mouth of Tomales Bay to the Point Reyes Bird Observatory, consists of 24,200 acres of wilderness and 8,530 acres of potential wilderness addition. Extending along nearly the entire coastline of the wilderness area and throughout Drakes Estero, the potential wilderness were not designated wilderness areas because the State of California maintains certain fishing regulation authority. Lacking complete authority of regulation of these areas, the National Park Service was unable to incorporate these coastal areas into complete wilderness areas. Outside of some already existing powerlines on Limantour Spit, development is prohibited in both the wilderness and potential wilderness areas.

The Point Reyes National Seashore includes the Point Reyes peninsula (64,546 acres) and was designated in 1962 "to save and preserve, for the purposes of public recreation, benefit, and inspiration, a portion of the diminishing seashore that remains undeveloped."

The upland area is wild and undeveloped and maintains populations of deer, foxes, badger, mountain lion and a variety of rodents and birdlife. The seashore contains unaltered rocky shores and sandy beaches which maintain rich intertidal communities, serve as breeding and haul out areas for marine mammals, and is a nesting area for seabirds.

The Outer Continental Shelf Lands Act Amendments of 1978 prohibits any exploration or development within 15 miles of the boundaries of the Point Reyes Wilderness Area unless the State of California allows it.

At present, one marine sanctuary exists in Central California. The Pt. Reyes/Farallon Islands Marine Sanctuary contains the largest breeding colony of seabirds in California and is an important pinniped rookery. The waters of the area are highly productive and are an important foraging area for the birds and pinnipeds. See Sections IV.E.2.d and 2e and BLM (1980) for further discussion on birds and pinnipeds.

The boundaries of the marine sanctuary are officially defined as follows (Figure III.B.8-1):

> "The Sanctuary consists of an area of the waters adjacent to the coast of California north and south of the Reyes Headlands, between Bodega Head and Rocky Pt. and the Farallon Islands (including Noonday Rock), and includes approximately 948 square nautical miles.
>
> The shoreward boundary follows the mean high tide line and the seaward limit of Pt. Reyes National Seashore. Between Bodega Head and Pt. Reyes Headlands, the Sanctuary extends seaward 3 nmi beyond State waters. The Sanctuary also includes the waters within 12 nmi of the Farallon Islands, and between the Islands and the mainland from Pt. Reyes Headlands to Rocky Point. The Sanctuary includes Bodega Bay, but not Bodega Harbor."

Oil development activities are not allowed in the Pt. Reyes/Farallon Islands Marine Sanctuary.

Cordell Banks near San Francisco has been nominated as a possible marine sanctuary, but no decision has been made concerning its eventual incorporation into the marine sanctuary system. As indicated in Section III.B.1, Cordell Banks is a shallow rise from the ocean floor which supports a rich rocky bottom community (including purple coral Allopora Californica) and attract large populations of fish. (Schmieder, 1982).

An active candidate for a marine sanctuary is Monterey Bay and surrounding waters. The boundaries on this proposed sanctuary are still being discussed (Ralph Lopez, personal communication). Monterey Bay is proposed because of the rich bottom areas highlighted by a submarine canyon.

In Southern California, the Channel Islands Marine Sanctuary could be affected as the result of Proposed Sale No. 73.

The Channel Island National Marine Sanctuary extends for 6 miles around the northern Channel Islands in the Santa Barbara Channel. It contains some highly productive waters and bottom communities, including an area of purple coral. Because of the high productivity, sanctuary waters are important for forage by the many important biological communities and species of the area. The sanctuary surrounds the largest pinniped rookeries in California, as well as important bird nesting areas, including that of the endangered brown pelican.

C. Socioeconomic Environment

1. Coastal Economy: The Central California counties that compose the study area have economies that are strong in tourism, agriculture, and fishing. Government is also a significant contributor to the economy of Central California. Tourist related activities are found primarily along the coast and around the major population centers.

The Central Califonria economy is also enhanced by the petroleum industry in both extraction and refining. Onshore employment is expected to remain constant over the life of the project, however, changes in the oil market, the quality of oil found offshore, and general economic conditions could result in a change in the industry's employment levels and structure.

The September 1982 labor force consisted of more than 468,000 people of which 38,850 were unemployed. The unadjusted unemployment rate of 8.2 percent is much lower than the 9.7 percent experienced by the state in the same period.

The following table shows wage and salary employment for the study area. Wage and salary employment is the number of people who receive compensation from businesses. Wage and salary employment is one indicator of the economic structure of an area.

Central California Wage and Salary Employment (1980)

Sector	
Total Wage and Salary	351,350
Agricultural Wage and Salary	36,875
Nonagricultural Wage and Salary	314,475
Mining	2,225
Construction	14,025
Manufacturing	39,025
Transportation & Public Utilities	15,450
Wholesale Trade	10,500
Retail Trade	69,500
Finance, Insurance, Real Estate	14,400
Services	74,800
Government	74,800

Table III.C.1-1 provides information on the expected level of the labor force between 1980 and 2010.

Table III.C.1-2 shows information on the level of earnings in the economic sectors anticipated to be impacted by Proposed Sale No. 73. The level of earnings in Table III.C.1-2 are the base from which the level of impacts have been measured.

2. Demography: The study area includes four counties for the purpose of demographic analysis and description. The four counties studied are Monterey, San Luis Obispo, Santa Barbara, and Santa Cruz.

The demographic characteristics which have been used to describe and analyze the study area are the subjects of Tables III.C.2-1 and -2. The characteristics of household size, minority population, home ownership, and average age were selected because of their ability to define social structure.

Population in the study area rose by 200,425 persons from 1970 to 1981 or an increase of 26.94 percent in 11 years. Home ownership in the study area is below both the State and national rates. The average household size is 1.1 percent smaller than the State and 3.6 percent smaller than the national average. Table IV.E.3.b-1 shows that population in the study area is expected to increase by 78.3 percent between 1980 and 2020.

3. Public Services and Facilities: This discussion of public services and transportation is limited to a discussion of the water supply, wastewater treatment facilities, transportation systems (roads, railroads and airports) and electrical power supply capabilities. Other services and facilities (e.g. schools, parks, police and fire protection) are not discussed. These facilities and services are impacted most by population increases. As discussed in III.C.2 and IV.E.3.a population increases associated with OCS development will be insignificant (less than 0.5%) when considering overall projected population growth and thus these topics are not included in this discussion.

TABLE III.C.1-1

PROJECTED LABOR FORCE FOR CENTRAL CALIFORNIA

1980*	1990+	2000+	2010
408,500	517,455	600,428	683,194

*State of California Health and Welfare Agency Employment Development Department

+MMS Estimates, 1983

TABLE III.C.1-2
SELECTED ECONOMIC COMPONENTS FOR CENTRAL CALIFORNIA
(IN THOUSANDS OF 1980 DOLLARS)

Economic Component	1980	1985	1990	2000	2020
Transportation, Communications, Public Utilities	378,591	459,788	558,508	814,193	1,531,641
Wholesale, Rentail Trade	1,198,461	1,404,045	1,645,169	2,289,070	3,991,250
Finance, Insurance, Real Estate	286,041	360,328	453,618	706,095	1,476,604
Services	1,394,667	1,716,247	2,111,868	3,185,694	6,364,232
Total Earnings	7,386,230	8,816,683	10,524,046	15,129,491	28,028,336

Source: OBERS Projections, 1972. U.S. Water Resources Council, Washington, D.C.

TABLE III.C.2-1

1970, 1980, and 1981 POPULATION FOR
CENTRAL CALIFORNIA COUNTIES

	1970*	1980*	1981**	% Change 1970-1981
Monterey	250,071	290,444	294,600	17.79
San Luis Obispo	105,690	155,345	158,900	50.33
Santa Barbara	264,324	298,660	299,500	13.32
Santa Cruz	123,790	188,141	191,300	54.52
Total	743,875	932,590	944,300	26.94
California	19,957,715	23,668,562	24,013,200	20.3

* U.S. Bureau of Census
**California Department of Finance May 1, 1981

TABLE III.C.2-2

SELECTED POPULATION CHARACTERISTICS
OF CENTRAL CALIFORNIA

	Average Persons per Household	% Ethnic or Racial Minority	% Owner Occupied Housing	Average Age
Central Coast				
Monterey	2.85	40.1	49.0	27.6
San Luis Obispo	2.50	14.6	52.4	29.9
Santa Barbara	2.62	24.8	50.4	29.7
Santa Cruz	2.54	15.8	52.8	30.6
Study Area	2.65	26.1	50.9	29.3
California	2.68	33.4	52.0	29.8
United States	2.75	20.3	58.6	30.0

*Source: U.S. Bureau of Census 1980 and Minerals Management Service

Water supplies in most areas are adequate to serve the existing populations during normal years. Drought conditions may severely strain some water systems and individual water wells. Wells provide the water supply for most of the coastal communities of Central California. Water supply systems are available in urban areas that have sufficient population to need such a service and to pay for it. The lack of availability of water, either from wells or from a service district, may hinder future growth and/or development.

Wastewater sewage treatment is accomplished by septic tanks and leach lines throughout most of the Central California coastal zone. As with water systems, sewage treatment systems are limited to urbanized areas. There are numerous municipal and industrial water treatment facilities that discharge waste water into the ocean. Some plants recycle treated waste water into irrigation uses. Urban municipal plant capabilities range from adequate, able to accommodate 10-year growth projections, to barely adequate, sewer hookup moratoria recently lifted. Generally the plant capabilities in northern Santa Barbara County are adequate to meet projected needs while the plant capability in San Luis Obispo County range from adequate to very little excess capacity. Morro Bay recently lifted a sewer hookup moratorium.

Transportation systems of the area include one state and one federal highway, a coastal railroad and several small to medium sized airports. State Highway 1 provides the main access to Morro Bay and to northern San Luis Obispo County coastline. The highway is 4 lanes from San Luis Obispo City to Morro Bay and then narrows to two large lanes along the coast. Traffic is heaviest during the summer tourist months. The major coastal north-south highway is U.S. Highway 101. This highway is generally located eastward of the first mountain range and runs along the coast between Goleta and Gaviota in Santa Barbara County and again in the Pismo-Avila Beach area of San Luis Obispo County. Highway 101 is a 4 to 6 lane freeway along most of its length with traffic heaviest during the summer tourist season.

Railroad service for freight and limited passenger service is provided by the Southern Pacific rail line. The railroad hugs the coastline in Santa Barbara County but runs inland parallel to Highway 101 in San Luis Obispo County.

The major airports in the area are located at the City of Santa Barbara, Santa Maria, and the City of San Luis Obispo. These airports provide a variety of services up to regularly scheduled passenger flights. There are several smaller airports that serve mostly recreational activities. Vandenburg Air Force Base occupies a large part of the northern Santa Barbara County coastline. Missile launchings and space shuttle flights are, and will be, regular occurrences from the Base.

There is one fossil fuel plant located in the coastal zone of the Santa Maria Basin at Morro Bay. The Diablo Canyon Nuclear Power Plant in San Luis Obispo County has not been fully certified and is not generating electricity. A liquified natural gas (LNG) facility is proposed to be located in the Point Conception area. Development of this plant has been postponed to the late 1980s.

Within Santa Maria Basin, water can be a limiting factor to new development in San Luis Obispo and Santa Barbara Counties (Schizos, 1982; Santa Barbara County, 1971). Continued overdrafting of the ground water to supply urban areas may cause serious problems of water table drawdown, salt water intrusion and possible subsidence. Wastewater treatment facility capabilities range from limited to adequate. Treatment facilities in northern Santa Barbara County are relatively new or recently renovated and are adequate to meet projected population growths for the area (Blayney-Dyett, 1981) Treatment facilities in San Luis Obispo County are more limited. Several systems have recently lifted moratoriums on new system connections (de Carli. 1982; San Luis Obispo County, 1979).

Transportation systems are adequate to accomodate current traffic needs. Highway 101 is a multilane freeway and provides adequate access. During the summer months it carries increased tourist related traffic. Two areas where the road system is lacking or limited are the northern Santa Barbara coast from Pt. Conception north, and the access to Port San Luis. Access to the northern Santa Barbara coastal area is limited because of the existence of few roads, and those that do exist are narrow and not paved. Vandenberg Air Force Base limits access to large portions of the coast. Access to Port San Luis is limited because of existing high traffic volume along the two lane access road from Highway 101. Traffic is particularly heavy on weekends. There is adequate space for new services at all the airports, Santa Barbara, Santa Maria and San Luis Obispo. There is adequate power supply to serve current and projected needs in both counties. When the Diablo Nuclear Power is finally certified and on line there will be additional power available.

4. Coastal Land Use: The discussion of coastal land use is restricted to that area defined as the coastal zone in California's approved Coastal Management Program (CMP) and in the California Coastal Act. The coastal zone may be up to 5 miles wide in rural areas or as narrow at 1,000 ft. in urban areas. The discussion may deal with other areas where necessary. Land use within the coastal zone is directed and controlled by California Coastal Commission (CCC) approved Local Coastal Programs (LCP) or Port Master Plans prepared by or for coastal cities and counties and harbors.

Generally the land use pattern in the coastal zone of Central California can be characterized as rural with large areas committed to cattle ranches, military bases, protected open spaces and small (5-10 acre) estates. Recreation tourism, cattle ranching and fishing are dominate uses along the coast. Many land areas are protected to various degrees by Federal, State or local government ownership. Urban uses are concentrated in areas along rivers or near harbors or bays. The main urban centers are the cities of Santa Barbara and San Luis Obispo, with other urban centers being Lompoc, Santa Maria, beach cities from Avila Bay south and Morro Bay.

Generally, housing availability in the coastal zone of Central California is limited in the low to moderate price range. Housing availability will continue to be limited because of the current economic situation and the decrease in the amount of Federal funds available for low to moderate housing construction. Limited availability of housing tends to drive up

the cost of existing homes and those houses on the market. Areas of the coast are limited in all types of future development by limited water supplies and sewage treatment facility capabilities. (See Public Services and Facilities in IV.E.18).

Industrial land use is limited in the coastal counties of the Santa Maria Basin. Areas zoned for energy related Coastal Dependent Industries (CDI) are usually small in size with limited capacity for expansion of the existing facility. Few acres have been zoned for expansion or development of new energy related CDI. (Refer also to Section IV.E.1-o).

Santa Barbara County and San Luis Obispo County (SLO) have both recognized the need to plan for potential OCS oil development and possible onshore related impacts. The Petroleum Transportation Committee, a joint industry and government study group headed by Santa Barbara County with SLO as a member, is studying and preparing recommendations for development needs in the Santa Barbara Channel and in the frontier areas of northern Santa Barbara and San Luis Obispo Counties. Santa Barbara County restricts future industrial development within the coastal zone to areas zoned Coastal Dependent Industries (CDI). These areas are few in number and small in acreage (Schizos 1982, Santa Barbara County 1979). San Luis Obispo, recognizing potential needs of the oil industry, has developed policies allowing expansion of existing oil and gas facilities on Nipomo Mesa or concentrating new development in that area (de Carli, 1982; San Luis Obispo, 1979).

The potential for any related development north of Port San Luis is restricted by County policy which recognizes significant deterrents to north County development from the environment and from the lack of adequate infrastructure (diCarli 1982). Supply boats for the Channel and the Santa Maria Basin currently utilize Port Hueneme as their harbor. Crew boats utilize the facilities at Ellwood, Gaviota, Port Hueneme and occasionally Port San Luis. Planning for Port San Luis has considered use of the Port as a crew boat base, but any development must also improve the recreational and existing commercial facilities and minimize conflicts with other uses (de Carli, 1982).

Growth in the coastal zone and in coastal areas has been predicted to increase in a manner similar to the last 10 years. The current economic climate may curtail that growth because of limited availability of housing, and limits in some areas on the availability of water, sewage treatment and other public services. Growth can also be controlled and/or directed by land use policies developed in county and city general plans, and local coastal programs required by the Coastal Zone Management Act of 1972.

The above discussions of county plans and zoning reflects current policies. All policies, plans, and zoning are subject to change and amendment. Early coordination with local government is necessary for any proposal if modification to existing land use zoning is needed to accommodate the proposed use.

5. Commercial Fisheries: California is an important center for commercial fishing interests. In 1980, over 365,000 metric tons (804 million pounds) of fish and shellfish worth $323 million to commercial fishermen were landed in California (U.S. Department of Commerce, 1981). This represents one-seventh of all landings in the United States. When the contributions of the support, processing, transportation, and marketing industries are considered, the total value of California's commercial fishing industry is over $1 billion.

About one-fourth of the landings into the State occur at central-northern California ports. The total annual landings of fish and invertebrates into these ports varies considerably from year to year depending in part on fish availability, market demand, weather conditions, and harvest regulations. Species composition of the catch also varies from year to year. In 1976, the most recent year for which comprehensive data are available, the most important species based on value that were landed into central-northern California ports were salmon, Dungeness crab, albacore tuna, rockfish, Dover sole, sablefish and giant Pacific oyster (see Table III.C.5-1). The most important ports in central-northern California based on value of landings are Eureka, Crescent City, and Fort Bragg.

Although landings into many central-northern California ports are small compared to the total State landings, the commercial fishing industry is a mainstay of the local economies of most communities in this area.

A large foreign fishery also occurs off part of the California Coast. In 1977, the Fishery Conservation and Management Act of 1976 (Public Law 94-265) was implemented giving the United States jurisdictional control and management responsibility for all fisheries except migratory tuna within 370 km (200 nautical miles) of the coast. The Pacific Fishery Management Council, in cooperation with the U.S. Department of Commerce, regulates the amount of harvest, harvest seasons and type of gear to be used by foreign and domestic fishermen in waters off California, Oregon, and Washington.

The port landings described above are useful to show the importance of commercial fishing to various communities and the general area where fish are caught. However, in reality fish often are caught long distances from the ports. The Commercial Fisheries visual shows the major fishing areas for the most important domestic fisheries. The locations of specific fishing areas are mapped by the California Department of Fish and Game (1980).

The following sections briefly describe the fisheries that are most vulnerable to oil and gas activities. An individual fisherman will often switch one or more times during the year from one fishery to another, depending on market demand, harvest regulations, and fish availability. More detailed information on commercial fisheries in central-northern California is given by Winzler and Kelly (1977) and Bureau of Land Management (1980).

Flatfish. The principal flatfish species caught in central-northern California are Dover sole, English sole, petrale sole, rex sole, sanddabs, and California halibut. Collectively, these fish are one of the most important groups of fresh and frozen market fish in California.

TABLE III.C.5-1

LANDINGS (1976) OF THE MORE IMPORTANT COMMERCIAL FISHES AND INVERTEBRATES AT
AT CENTRAL-NORTHERN CALIFORNIA PORTS
PRESENTED AS PERCENT BY VALUE OF TOTAL STATE LANDINGS

PORT	MAJOR SPECIES OR GROUP Dover Sole	English Sole	Petrale Sole	Rex Sole	Sanddabs	California halibut	Rock fish	Sable-fish	Salmon	Albacore tuna	Lingcod	Northern anchovy
Crescent City	14	23	8	14	20		4	4	9	2	13	
Trinidad									2			
Eureka	49	18	22	34			14	19	23	8	14	
Ft. Bragg	16	7	14	22			16	17	21	7	22	
Albion									3			
Bodega Bay	5	7					3		11	2		
Drakes Bay (Pt. Reyes)									1			
Sausalito									4	1		
San Francisco	7	24	31	13	46		7		2	1	23	
Oakland									2			
Princeton									3	1		
Santa Cruz									3			
Moss Landing	7						5	6	8	15		4
Monterey		7					14	46	4	4		
Morro Bay			10				11		2	6	12	
Port San Luis (Avila)						10	5		2	1		
All central-northern California Ports	98	86	85	83	66	10	79	92	100	48	84	4
Total Value of State Landings (in thousands of dollars)	$3,068	$874	$814	$411	$266	$536	$3,977	$1,259	$10,707	$12,723	$458	$4,628

Source: Oliphant (1979)

TABLE III.C.5-1
LANDINGS (1976) OF THE MORE IMPORTANT COMMERCIAL FISHES AND INVERTEBRATES AT CENTRAL-NORTHERN CALIFORNIA PORTS
PRESENTED AS PERCENT BY VALUE OF TOTAL STATE LANDINGS (CONTINUED)

PORT	MAJOR SPECIES OR GROUP Pacific herring	Dungeness crab	Rock crab	Red abalone	Giant Pacific oyster	Pacific ocean shrimp	Spot prawn	Market squid	PORT TOTAL
Crescent City		41				37			4
Trinidad		5							<1
Eureka		42			66	47			7
Ft. Bragg		7				15			3
Albion									<1
Bodega Bay	14	2							1
Drakes Bay (Pt. Reyes)					30				<1
Sausalito	21								1
San Francisco	51	2							1
Oakland									<1
Princeton		1		10					<1
Santa Cruz									<1
Moss Landing									2
Monterey							31	43	2
Morro Bay									1
Port San Luis (Avila)			17						<1
All central-northern California Ports	86	100	17	10	96	99	31	43	22.7
Total Value of State Landings (in thousands of dollars)	$483	$10,275	$342	$704	$995	$683	$182	$747	$182,789

Flatfish are caught with trawl gear throughout the year. In most waters off California, trawling is prohibited within 5.6 km (3 nautical miles) of shore. Major trawl grounds are found along the entire coast outside this 5.6 km limit. The trawl gear consists of a net bag with bridles attached to each side of the bag. When towed on the bottom the net bag is spread by otter boards or doors that are fixed to the bridles. Vertical spreading is accomplished in the front of the net by floats at the top and weights such as a chain at the bottom of the net.

Flatfish are landed whole, held in ice, cut into fillets, quick-frozen and sold to local California markets. About 60 percent of the fish is waste. Much of this waste is thrown away or used for pet or mink food.

Rockfish. Rockfish are of major importance to commercial and sport fishermen. Eight species predominate in the commercial catch. Two or three rockfishes of different species often live in close association, and they are caught together. Most rockfish are found near reefs, kelp beds, and other rocky areas from the intertidal zone to at least 550 m (1,800 feet).

Rockfish are caught throughout the year primarily by mid-water trawl gear, longline gear, trammel nets, or gill nets. Fishing grounds occur along the entire California coast.

Rockfish often make up a large part of the general category of market fish and are landed whole, filleted, and sold fresh in all local markets.

Sablefish. Sablefish is one of the most numerous benthic fishes below a depth of 200 m (650 feet). Sablefish prefer soft, muddy bottoms but can be found in areas that have sandy and rocky bottoms.

Fishing for sablefish occurs throughout the year. Catches made by longlines and pots are primarily over irregular bottoms where trawlers cannot fish. The trawl catch of sablefish is incidental with catches of English and Dover sole. The fishing grounds are located on mud bottoms off all major fishing ports.

Sablefish are usually landed whole and then graded by size. Higher prices are paid for larger sablefish. The smoked fish market prefers fish over 2.3 kg (5 pounds), whereas small ones are usually processed into fillets and sold in the market as butterfish.

Salmon. Salmon are harvested throughout the Pacific Northwest. In California waters, king salmon and silver salmon are the principal species harvested. In recent years, salmon have been one of the most valuable fishes per kilogram in the California commercial fishery. The salmon fishery is one of the oldest on the coast. Industrial, agricultural, and domestic uses of freshwater have severely reduced wild runs of salmon. Hatchery-reared salmon, released at the time and size of their natural migration to the sea, now contribute significantly to the commercial ocean catch. The number of salmon fishermen entering California's fishery is controlled, and they compete for salmon stocks that are still under great pressure from freshwater developments and habitat degradation.

Salmon are taken commercially with troll gear from about mid June to early August depending on when fishing for salmon is allowed. California's catch mainly is taken from Monterey north to Crescent City. A few salmon are landed south of Monterey, but generally amount to less than 15 percent of the State's total. King salmon almost totally dominate the commercial salmon catch landed at ports around Monterey and San Francisco. Northern California ports now land catches of silver salmon which rival in size those of king salmon. The best ocean salmon fishing in California is a few kilometers offshore.

Albacore Tuna. The albacore tuna is a pelagic schooling fish inhabiting the Pacific Coast of North America as far north as Vancouver Island during the summer and fall. As albacore move toward the eastern Pacific, they enter the American commercial fishery. Albacore fishermen often fish for salmon until albacore reach the coast.

Albacore are generally taken by trolling 8 to 10 lines at the surface from May through November. Major fishing grounds are located seaward of Cape Mendocino and Monterey in the vicinity of the Pioneer and Davidson Sea Mounts.

Albacore are frozen at sea and remain frozen until processed at canneries located in Oregon or Southern California. Fish are trucked to these areas from local buying stations along the coast.

Lingcod. Lingcod ranges from Baja California to northeastern Alaska. It is sought by both sport and commercial fishermen.

Most lingcod are taken incidentally in the trawl fishery out of San Francisco and Eureka. Salmon trollers or boats of similar size catch lingcod in the fall and winter with gill nets, longlines, and hook and line.

Lingcod are landed whole, filleted, and sold in local fresh fish markets and restaurants.

Northern Anchovy. The anchovy, a pelagic schooling fish, is the most numerous fish in the California Current. The collapse of the sardine fishery and the great decrease in sardine numbers in the 1940s has been followed by a large increase in numbers of anchovies. A law prohibiting reduction plants in California curtailed development of the anchovy fishery until 1965 when an anchovy reduction quota was established. Presently, most of the effort in the fishery is in the Monterey Bay area and south of Pt. Conception. Catches are increasing in both areas.

The season for fishing is year-around. Off Monterey, the main fishery occurs in the spring and summer when the anchovies are close to shore. Most of the fishery occurs within 46 km (25 nautical miles) of Moss Landing where the reduction plant is located. Less is known of the seasonal availability of anchovies to fishermen north of San Francisco. Two types of fisheries occur, one for reduction, and one for bait. Anchovies for the reduction fishery are caught with purse seines from boats in the 24 meter (80-foot) class with the capability of 200-metric-ton catches a night. The bait fishery uses smaller boats in the 15-meter (50-foot) range and the lampara is the primary net used. Anchovies for bait are taken in or near Monterey, Morro, and San Francisco Bays in summer and fall. Only three or four boats work out of each port.

Fish for reduction are processed into fish meals and oil. Bait is packaged and frozen for state-wide distribution to sport and commercial fishermen. Some live bait is held for sale in net pens.

Pacific Herring. The Pacific herring is a pelagic schooling fish that ranges in the eastern Pacific Ocean from San Diego to the Bering Sea. Herring are harvested for their eggs.

The fishery for herring is during fall, winter, and spring when herring enter estuaries to spawn. Four types of gear are used in the herring fishery. Purse seines are most important and they take most of the catch. The boats used are in the 18-24 m (60 to 80-foot) long range. Lampara nets are worked from boats about 15 m (50 feet) in length. Gill nets are gaining in use because they take herring with the highest egg yields. Beach seines are of minor importance in taking herring.

The major fishing areas are Tomales and San Francisco Bays. Minor fisheries occur in Monterey Bay and Humboldt Bay. Beginning in 1976, fishing began outside, but within a few kilometers of these bays. Large, gravid fish are preferred by fishermen because they are paid on an egg-yield of female herring. Fishermen indicate that gill nets tend to take consistently high egg-yielding fish, and such fish are most abundant in bays as they come to spawn.

Herring are bought in San Francisco and Tomales Bays, salted and stored in bins until eggs can be extracted from females. Some herring are shipped out of the State for egg extraction. Eggs are shipped to Japan for human consumption. Little is done with herring carcasses after eggs are taken. There is a move to use herring waste for animal feed and for reduction.

Crab. The Dungeness crab, *Cancer magister*, has a reported range from Magdalena Bay, Baja California, to Unalaska, Alaska, but it is considered rare south of Pt. Conception in California. It has a definite preference for sandy bottoms. Occasionally, it will be found in mud, and only rarely in rocky areas. Although it may be found in depths of at least 229 m (750 feet), it is not abundant over 91 m (300 feet), and the greatest concentrations occur at depths between 2 to 37 m (6 to 120 feet). The life history involves a larval stage which may last 3 to 5 months. During this interval, the larvae are part of the zooplankton found in the upper 20 m (65 feet) of the ocean. Initially, post-larval stages take up a benthic position in coastal shallows. Thus, bays and estuaries act as significant nursery grounds for the first 2 years of life. The Dungeness crab population shows both cyclic abundance and localized depletion of stocks. The crabs are taken commercially by circular steel traps.

There are three species of *Cancer* crabs collectively referred to as rock crabs. These are the yellow crab, *C. anthonyi*, the rock crab, *C. antennarius*, and the red crab, *C. productus*. All three are inshore species and are found on a variety of substrates, particularly in rocky areas. Rock crabs support a sizeable sport fishery along the entire coast, but commercially they are taken only in the lower half of California.

Red Abalone. Eight species of abalone occur in California, but only red abalone, *Haliotis rufescens*, is fished extensively in central-northern California. Red abalone range from Sunset Bay, Oregon, to Turtle Bay, Baja California. They are fished by divers in depths of 8 to 55 m (25 to 180 feet).

Giant Pacific Oyster. California's oyster industry is not based on the exploitation of a native marine resource, but depends on the culture of two important species: the eastern or American oyster, *Crassostrea virginica*, and the Pacific or Japanese oyster, *C. gigas*. The native "Olympia" oyster, *Ostrea lurida*, is not abundant and is not sought for commercial or sport use. Pacific oysters are grown in several areas including Arcata Bay, Tomales Bay, Drakes Estero, Elkhorn Slough and Morro Bay and landed in large numbers in central-northern California.

Shrimp. The Pacific ocean shrimp, *Pandalus jordani*, are found from Unalaska in the Aleutian Islands to off San Diego, California, at depths from 46 to 366 m (150 to 1,200 feet). Spawning probably occurs throughout their range in California, and few survive beyond their fourth year. Shrimp are harvested using specially designed trawls.

The distribution of the spot prawn, *Pandalus platyceros*, is from Unalaska to off San Diego, California, in waters 46 to 488 m (150 to 1,600 feet) deep. The canyons off Monterey are the primary commercial fishing area in central-northern California but there also is an important fishing ground off Morro Bay and Avila. Spawning takes place in the same areas, from 152 to 213 m (500 to 700 feet) in depth, where the prawns are fished. Spot prawns are fished with traps.

Market Squid. The opalescent or market squid, *Loligo opalescens*, ranges from British Columbia to Central Baja California and may occur in the Gulf of California. The squid fishery is based on schools that are moving inshore to spawn. Beginning in May, the bulk of the catch is taken in at Monterey Bay by lampara boats. In Southern Califonria, the catch is taken in by light-attraction methods in December.

Mariculture. Mariculture is the culture and growth of marine plants and animals. In addition to the culture of salmon and oysters discussed above, important mariculture operations include raising red abalone and clams. Red abalone are grown near Cayucos (San Luis Obispo County) and Monterey (Monterey County). Clams for seeding are raised in Arcata Bay, San Francisco Bay, Elkhorn Slough (Monterey County) and near Cayucos (San Luis Obispo County).

6. Sportfishing: Sportfishing is an important recreational activity throughout Central California. Many tourists are attracted to the area by the rich supply of marine resources. Six fishing methods predominate in the Central California ocean sportfishery: shore, pier, skiff, party boat (commercial passenger fishing vessel), skin diving (including SCUBA), and surf netting. Shore and pier fishing are by far the most popular methods, receiving over 80 percent of the hook-and-line effort (Miller and Beibel, 1973). Skiff, party boat skin diving, and surf nettering follow (Yount 1969). Although more effort may be expended in shore and pier fishing, more fish per hour may be caught from boats.

Over 135 species representing 41 families have been recorded in the California sport catch north of Pt. Conception. However, only about 20 species are caught in large numbers. The species of most importance in the fishery as a whole include: rockfish, lingcod, king salmon and silver salmon. The most caught species by number and weight are listed in Table III.C.6-1 and can also be found in the FEIS for OCS Sale No. 53 (BLM, 1980).

Habitat type and fishing method can affect the species composition of the catch. The more frequently caught species for the various habitat types can be found listed in the FEIS for OCS Sale No. 53 (BLM, 1980).

Additionally, several invertebrates are taken by sportsfishermen in California north of Pt. Conception. Clam digging occurs along many beaches. Abalone are taken along the entire coastline, however, SCUBA may be used to take abalone south of Yankee Point.

Fishing from boats takes place along the entire coast, however it is concentrated in areas such as Morro Bay, San Francisco Bay, Monterey Bay, Tomales Bay, and Humboldt Bay (see Figure III.C.6-1). The distribution of boating and the number of participation days for the California Coast are given in POCS Technical Paper No. 81-5 (The Granville Corporation, 1981).

The economic value of sportfishing can be approximated using the data presented in the report by the Granville Corporation (1981). This places the value in excess of $75 million in 1980, but does not include the value to the fishermen of the actual catch. A more detailed description and analysis of marine recreational fishing for the Pacific Coast should become available from the Pacific Marine Fisheries Commission in the near future.

7. Recreation: The Central California coast is a highly sensitive natural resource area and is an important recreational asset to the residents of the State and to tourists. It is an extremely diverse area in respect to the landscape, in that it varies from rugged, wind blown cliffs to flat sandy beaches with stable dune backshores. This diversity creates a unique area which changes character at every bend of the shoreline and embayment, attracting tourists from all parts of the world to view the scenery and enjoy the solitude of vacationing in a relatively pristine environment. Along the coast, recreation is primarily water-oriented, both from an active participation, and from an aesthetic and passive aspect. There are numerous public and privately owned recreational sites which have direct access to the ocean. The Federal and State owned areas in Central California are shown on Figure III.C.7-1. A complete listing of recreational sites is presented in POCS Technical Paper No. 81-5 (The Granville Corporation, 1981). Access sites have been listed and described for the California Coast by the Coastal Commission in the California Coastal Access Guide (1981).

The major recreational activities of the California coast are sightseeing, beachcombing, picnicking, boating, swimming, wading, sunbathing, diving, surfing, and sportfishing. Sightseeing and beachcombing are enjoyed along the entire coast and are mainly dependent on the aesthetic aspect of the area (see POCS Technical Paper No. 81-5).

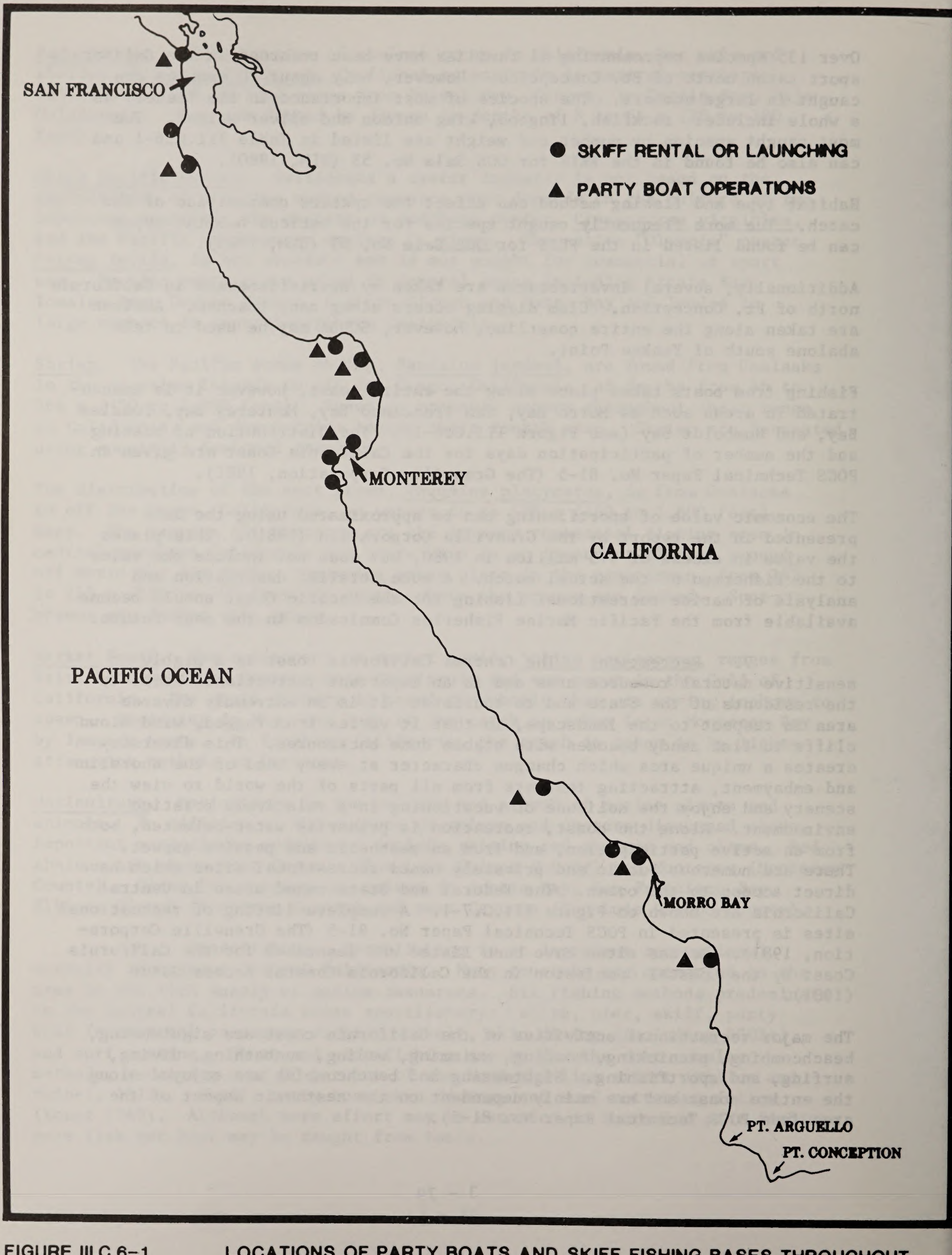


FIGURE III.C.6-1 LOCATIONS OF PARTY BOATS AND SKIFF FISHING BASES THROUGHOUT CENTRAL CALIFORNIA.

TABLE III.C.6-1

TOP TEN SPECIES CAUGHT BY NUMBERS AND WEIGHT, 1980
(EXCLUDES SALMON ANGLERS AND THEIR CATCH OF OTHER SPECIES)

Number	Weight
Surf Smelt	Lingcod
Night Smelt	Surf Smelt
Blue Rockfish	Blue Rockfish
Brown Rockfish	Black Rockfish
Northern Anchovy	Yellowtail Rockfish
White Croacker	Olive Rockfish
Yellowtail Rockfish	Canary Rockfish
Black Rockfish	Bocaccio
Redtail Surfperch	Redtail Surfperch
Lingcod	Cabezon

Source: MARINE RECREATIONAL FISHERY STATISTICS SURVEY, PACIFIC COAST

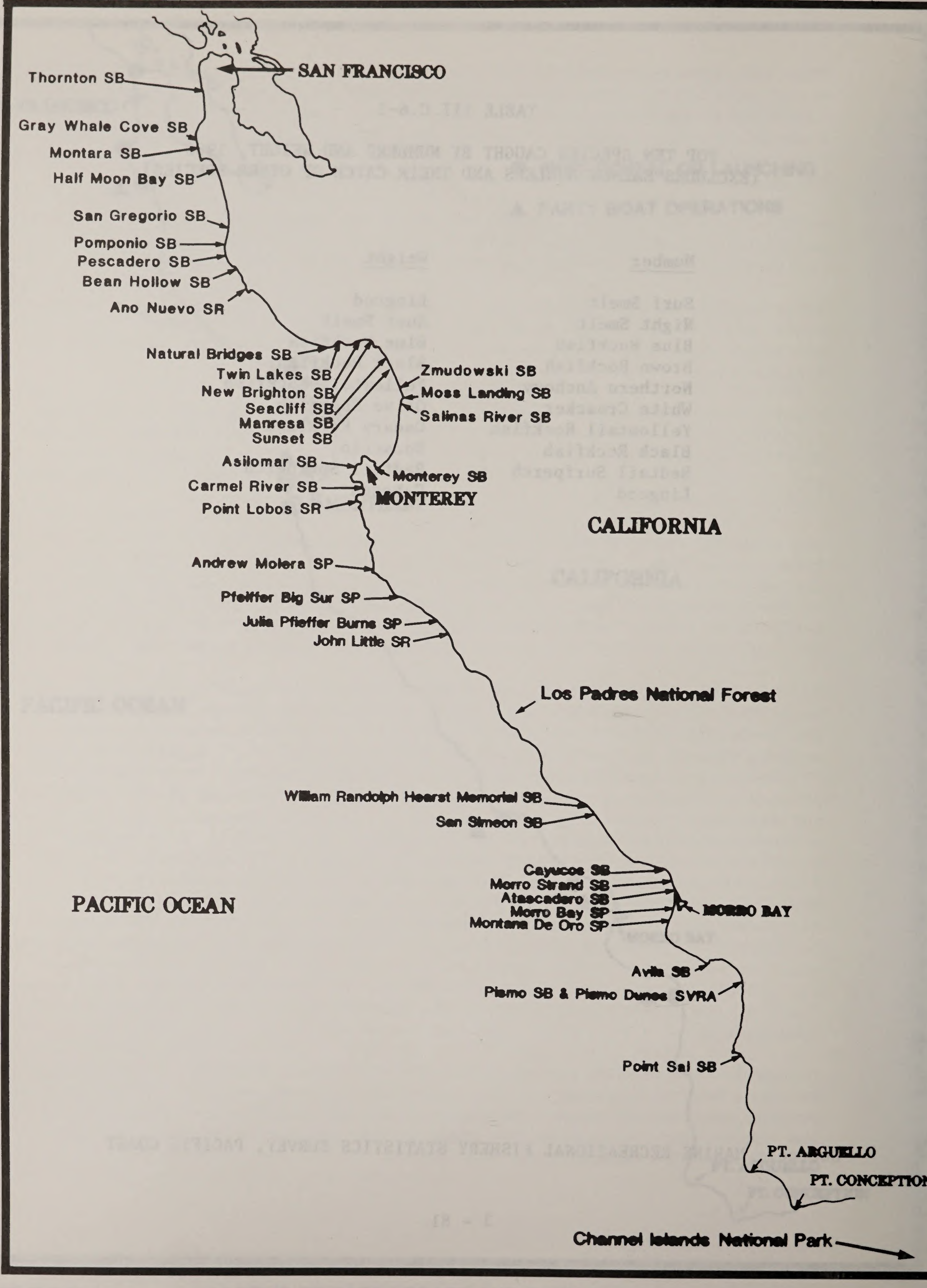


FIGURE III.C.7-1 FEDERAL AND STATE RECREATION AREAS ON THE CALIFORNIA CENTRAL COAST.

Picnicking is mainly family group oriented and tends to be concentrated at easily accessible recreational facilities. Boating is not limited to any specific area along the coast, although concentrations are found at the major bays.

Swimming, wading, and sunbathing are primarily summer activities and occur mainly on sandy coast type beaches. Diving occurs along the entire coast and is growing more popular each year.

Surfing depends entirely on the climatic and oceanic conditions that are present at each of the suitable surfbreaks. There has been a large increase in surfing over the past few years due to the use of wet suits to protect the surfers from the cold water that is found in this region. This has allowed surfing to spread along the entire coast of California, which when joined with the other recreational activities, places a heavy use on the coast.

Morro Bay, Monterey/Carmel, Santa Cruz, and San Francisco are examples of tourist/recreation centers in the area. Several recreation areas are intensively used, such as the Pt. Reyes National Seashore and the Golden Gate National Recreation Area which had a combined attendance of over 14 million in 1980, National Park Service, 1980, personal communication).

The economic value of recreation in Central California is in excess of $387 million (based on The Granville Corporation, 1981). This value only considers the expenditure involved in furnishing the activity. Thus, although gate figures are not available for all recreational facilities, a general participation trend can be obtained from attendance for State parks and the number of boating days. These figures have been collected and future projections are found in POCS Technical Paper No. 81-5 (The Granville Corporation, 1981).

Additionally, one must consider the cost of recreational equipment such as boats, water skis, diving gear, camping equipment, surfboards, and fishing tackle, which will increase the economic dependence of the local communities on recreation.

8. Tourism: Tourism is one of the major industries in California, and has been recognized as an important element in the regional economy.

Tourism has been defined by the California Office of Tourism as "non-routine visits to an area for pleasure, business, meetings, or other purpose." This means that any trip of a non-routine nature will be included in the total value of the tourist industy, as opposed to only the vacation/pleasure trips which are considered the more traditional tourist forms.

Most of the coastal communities can be considered tourist centers, as they are economically dependent upon both transient and stationary tourism. Transient tourism is popular along the coast as can be seen by the number of tourists who drive along sections of the coastal highway. Stationary tourism is important in that the total expenditure of the tourist will be added to the local economy, and will also have a direct bearing on the sportfishing and recreation of the local area.

San Francisco is the most important tourist center in central-northern California. This is due to the number of tourist attractions such as the Golden Gate Bridge, Lombard Street, Fisherman's Wharf, the Cable Cars and Chinatown. In addition, San Francisco is one of the major cultural and fine arts centers on the west coast.

In 1979, San Francisco County had a travel expenditure of almost $2.5 billion (California Office of Tourism, 1981a), which was 17.8 percent of the total State travel expenditure. Travel expenditure is defined as the amount spent by tourists on round trips of 200 miles or more. Of the total spent by tourists, approximately 46 percent is spent for vacation use (California Office of Tourism, 1981a), thus, in San Francisco County, approximately $1.1 billion was spent on the traditional form of tourism. This is determined by the estimate that tourists spent 12.3 percent of their cost on lodging. (The Granville Corporation, 1981).

The overall value of coastal tourism for the Central California coast is shown in Table III.C.8-1.

Employment figures for the tourist section of the economy are very difficult to obtain as most of the tourist industry also serves the local resident populations. However, based upon the regional multipliers (The Granville Corporation, 1981) and the total tourist expenditures (over $1.6 billion in 1979), it is approximated that over 240,000 jobs in central-northern California are dependent upon tourism for payroll contributions.

9. Visual Resources: The Central California coastline is an outstanding visual resource of great variety, grandeur, contrast, and beauty. Visual attractions such as the dramatic meeting of land and water, unspoiled natural areas filled with wildlife, and the rich texture of urban shorelines add to the quality of life.

Since the conception of what is aesthetic or beautiful is wreathed in human creativity, emotion, philosophical standards, and cultural background, widely divergent views can emerge from any discussion of visual resources. Certain principles do emerge which are suitable for analytical treatment. These are primarily concerned with the visual perception, as other types of stimuli such as sound and smell are fairly easily characterized as pleasant, neutral, or unpleasant. Visual attractions such as the dramatic meeting of land and water, the framed and unframed views of the ocean, the texture of the vegetation and urban areas, and the overall harmony of the scene add or detract to the quality of life for coastal residents and visitors, and will contribute to the economic success of the tourist industry by attracting vacationers to the shoreline.

The systematic analysis of scenic quality is a complex and difficult task because of the great variety of natural and man-made conditions along the California coast. The Bureau of Land Management had developed a rating system that attempts to objectively rate, on a regional scale, the visual quality of the various landscapes on the California coastline. This system is based on a landscape architectural viewpoint and has incorporated the texture, harmony, variety, cultural modifications, vegetation, and form of the area into the rating methodology.

TABLE III.C.8-1

VALUE OF TOURISM IN CENTRAL CALIFORNIA COAST (1979)

	Total Lodging Receipts (1)	Vacation/Pleasure Lodging (2)	Vacation/Pleasure Total Expenditure (1)
Marin	6,193,675	2,849,090	23,163,337
San Francisco	305,843,569	140,688,042	1,143,805,218
San Mateo	23,336,567	10,734,821	87,274,965
Santa Cruz	11,872,562	5,461,379	44,401,453
Monterey	63,532,361	29,224,886	237,600,699
San Luis Obispo	15,530,283	7,143,930	58,080,734
Santa Barbara	5,524,050	2,541,063	20,659,049
Total	431,833,067	198,643,211	1,614,985,455

(1) Based on Bed Tax Receipts

(2) 46% of Hotel/Motel Receipts are from Vacation/Pleasure Use (California Office of Tourism 1981a)

(3) 12.3% of Tourist Expenditure is for Lodging (The Granville Corporation, 1981)

SOURCE: CALIFORNIA OFFICE OF TOURISM, 1981, LOCAL TOURISM PROMOTION PROGRAM

The rating of the coastline, although subjective, does present the aesthetic quality of the coastline on a physiographic scale. Each landscape unit is rated on the same basis. The units are rated on their own standing, and not in relation to any other unit. This permitted a relative aesthetic quality of the California coast to be obtained; however, the use and accessibility levels for each unit are not considered. The complete results of the study are given in POCS Technical Paper No. 81-5 (The Granville Corporation, 1981); however, the values given in the study should not be taken as absolute, but should be used to show the relative trend of the aesthetic value of the coastline.

Among the more pristine and aesthetic regions of the California coast based on the study are the Gold Bluffs, the Eel River Delta, Devil's Gate, Kings Range, Westport area, Mendocino, Elk area, Stewart Pt. to Fort Ross, Pt. Reyes Headland to Stinson Beach, Golden Gate, San Gregorio to Pt. Ano Nuevo, Santa Cruz area, Monterey, Pacific Grove, Big Sur Coast (Pt. Lobos to San Luis Obispos Countyline), Pt. Buchon, and Pt. Sal. This list should not be taken as being all inclusive, but should be used to show the general trend of the aesthetics of the coast.

Property values of the region also tend to be tied to the aesthetics of the local areas, with the more aesthetically pleasing areas tending to have a higher real estate value than the other areas.

Accessibility of the areas tends to be less, or virtually nonexistent for the more pristine areas, and, thus, these areas tended to have less use than the more developed and easily accessible areas. An example of this is the Kings Range which is a pristine area, but due to its inaccessibility is virtually unused. The converse is seen along the Big Sur Coast which is a scenic route and has a relatively high visitor use. Some areas have high recreational use due to their being accessible, having relatively high aesthetic rating, and being close to centers of population. This is seen in the Golden Gate National Recreational Area which had an attendance of over 14 million visitors in 1980. This area is a highly scenic area and is within the general driving range for a day trip from San Francisco.

In general the Central California coast is a highly diverse region with an overall very aesthetically pleasing texture. Thus, any attempt to rate it has to be a subjective estimate of what qualities are important in reflecting the relative aesthetic qualities of the California Coast.

10. Cultural Resources: Cultural resources are prehistoric and historic remains comprising a non-renewable resource base that provides anthropologists and historians with information for reconstruction of past cultural systems and behaviors. Cultural resource management by individuals, institutions, and governmental agencies involves the identification of these resources, their protection, and preservation for maximum longevity (Lipe, 1977). In addition to traditional cultural (i.e., archaeological) resource concerns, religious and other cultural elements of concerned ethnic minorities are addressed in this document.

Early Man in California. It is not certain when the California Coast was first occupied because worldwide sea level changes (eustatic variation) may have submerged the archaeological remains of those early coastal dwellers. Sea level has varied greatly during recent and Pleistocene times (Quaternary). This means that much of the early coastal region probably occupied by the earliest Californians is presently submerged.

Terrestrial Cultural Resources. The coastal lands contain numerous archaeological sites, most of which represent Native American resources. The heavier concentration of sites recorded in some counties is partially a reflection of large indigenous populations (e.g., Santa Barbara County), and mainly the result of the degree and intensity of surveying.

In recent years, there has been an increased interest in historical archaeology. California's long history is providing a wealth of archaeological material from the different ethnic and cultural groups which have settled in California.

Contemporary Native Americans. There are presently about 15-20,000 Native American residents in the central-northern coastal counties, although many are from other areas and States.

Subsistence gathering continues today both inland and on the coast. The intertidal zone is especially important to coastal dwellers. Although not well documented, family-gathered foodstuffs account for up to 25 percent of total subsistence for some Native American families. Traditional medicines, herbs, and teas are also gathered.

Gathering for ceremonial purposes is primarily documented by BLM and others, in the Pt. Conception area.

Both subsistence and ceremonial gathering has been reduced in recent years because of a decrease in the supply of traditional plant and animal foods. Although the intertidal zone is controlled by the State, beach access in many areas is restricted by private property owners.

There are numerous geographic landmarks and areas that are of special concern to Native Americans because they were traditionally used by their ancestors. Many of these places are still being used in traditional ways. In addition, there has been a resurgence of interest in traditional practices and beliefs both among those who were raised in these cultural experiences and among those individuals who have adopted these ways of life.

Offshore Cultural Resources. The offshore region of California is believed to contain numerous cultural resources. Types of submerged resources are aboriginal remains, and sunken ships and aircraft. The field of marine archaeology in this region has developed only recently. Thus far, most marine prehistoric work has occurred in Southern California in the San Diego and the Santa Barbara Channel areas. This does not necessarily reflect a lack of resources along the Central Coast, only a lack of investigation in those areas.

Shipwrecks are important because they capture an instant in the life of a culture and preserve it fairly intact. Sinking was generally in the violent circumstances of war, storm, or sudden encounter with unseen reefs or rocks, none of which usually provided ample warning or opportunity to salvage. Increased numbers of shipwreck artifacts have been recovered offshore California in recent years. Materials which have been recently salvaged from old wrecks include such small and perishable items as fabrics, spools of ribbon, hats, shoes, foodstuffs, awls, and needles. Studies have identified over 1,500 vessels that were reported lost along the coast of California. Most of the losses have been reported in State, rather than Federal waters. Though the locations of historic shipwrecks have been in some cases precisely noted, they are often many miles from the location of their reported loss. Location errors have occurred because of navigational error, loss report error, or because of vessel drift. It is not uncommon for an abandoned damaged ship to drift for a long distance prior to eventual sinking. For these reasons, it is very likely many of the shipwrecks reported in State waters actually occurred in Federal waters.

11. Ports and Harbors: Nine major ports/harbors exist in the Central California Planning Area: San Francisco Bay Entrance, San Francisco, Redwood City, Oakland, Richmond, San Pablo Bay and Marc Island Strait, Carquinez Strait, and Suisun Bay Channel (refer to Visual No. 2, BLM 1980). These ports provide access to local and regional markets as well as foreign commerce.

Numerous fishing ports exist between Crescent City in Northern California to Avila Bay in Central California. The ports provide berthing space and support facilities for the commercial fishing industry and recreational boating enthusiasts (refer to Sections III.C.5 and 6). Recreational boating activity is primarily confined to the area between Monterey and San Francisco.

12. Marine Traffic: Commercial and military vessel traffic offshore Central California is routed through a system of Traffic Separation Schemes and Port Access Routes that are established by the U.S. Coast Guard. A Traffic Separation Scheme (TSS) is an internationally recognized vessel routing measure which serves to provide a separation of opposing flows of vessel traffic. A Port Access Route (PAR) generally consists of a Precautionary Area and associated TSSs. Precautionary Areas are defined as areas within defined limits where vessels must navigate with particular caution.

At the time of this writing, a PAR lies off the San Francisco Bay entrance. The PAR consists of a Precautionary Area with northern, western, and southern TSS approaches (refer to Visual No. 1, BLM, 1980). The Santa Barbara Channel TSS lies immediately below the proposed sale area.

The total freight traffic between Pt. Conception and the California-Oregon Border for calendar year 1977 is presented in Table III.C.12-1. A total of 3,781 vessels arrived at the San Francisco Bay in calendar year 1981. This represents an average of three tankers and seven other types of vessels (i.e., cargo, passenger) per day that entered the Bay during 1981. The total number of vessels arriving in the Bay has declined about 28 percent

TABLE III.C.12-1

TOTAL FREIGHT TRAFFIC FROM POINT CONCEPTION TO THE SAN FRANCISCO BAY

Harbors	Total Waterborne Tonnage[a] (Short Ton = 2,000 Pounds)	Vessel Arrivals[b]
Moss Landing	2,204,350	85
San Francisco Bay Entrance	56,183,514	4,221
San Francisco	1,931,693	6,927
Redwood City	410,293	175
Oakland	6,828,938	4,992
Richmond	23,823,508	6,298
San Pablo Bay and Mare Island Strait	26,712,751	4,139
Carquinez Strait	24,740,631	3,668
Suisun Bay Channel	7,920,404	1,719
Total (Excluding S.F. Bay entrance)	94,572,568	28,359

Source: Department of the Army Corps of Engineer, 1977. Waterborne Commerce of the United States, Part 4.

[a]Includes military shipping.
[b]Excludes domestic fishing craft, military ships, pleasure boats and through traffic.

since 1968, when there were 5,218 vessel arrivals. The number of vessel arrivals at the Los Angeles-Long Beach ports was 7,343 in calendar year 1981 (i.e., about 20 vessels per day). At the time of writing, about 24 vessels pass through the Santa Barbara Channel each day. This marine traffic consists of about 30 percent tankers, 20 percent containerships, 25 percent breakbulk cargo ships (i.e., freighters), 13 percent dry bulk carriers, and 12 percent other type ships such as auto carriers, lumber ships, passenger ships, etc. (U.S. Dept. of Commerce, 1981a).

The U.S. Coast Guard (Twelfth and Eleventh Districts) has recently completed studies of the potential traffic density and the need for safe access routes offshore California. These "Port Access Route Studies" were mandated by the Ports and Waterways Safety Act (PWSA) (Public Law 95-474; 92 Stat. 1473; 33 U.S.C. 1223). Based on the results of these studies, the PWSA designated the Coast Guard to propose appropriate vessel routing measures such as safety fairways and traffic separation schemes. These measures would provide safe access for vessels that proceed to and from ports or places subject to the jurisdiction of the United States.

The Twelfth and Eleventh Coast Guard Districts have recently published their Port Access Route Study results and recommendations (Twelfth District: Federal Register Vol. 47, No. 199; Eleventh District: Federal Register Vol. 47, No. 122). At the time of this writing, these recommendations have not been adopted. Possible implementation of the recommendations will involve the following: a) a notice of proposed rulemaking with subsequent public, private, and governmental input, and b) an application to the International Maritime Organization. These actions are proposed to be initiated by the Coast Guard by mid-1983. The recommendations of each district follow. See Figure III.C.12-1 for a visual depiction.

Twelfth District. The San Francisco TSS would be retained with northern, western and southern approaches. These approaches would be changed, based on the results of the Port Access Route Study.

The northern and southern lanes would be reoriented and the southern lanes lengthened. A shipping safety fairway would lie over the Precautionary Area and each of the traffic lanes. The portion of the routing measure that extends southward from the San Francisco TSS's southern approach lanes would be a 120-mile long, five-mile wide shipping safety fairway. These routing measures were designed to align with those recommended by the Eleventh District. The Coast Guard is considering the use of a fairway to overlay the extension of TSS lanes proposed by the Eleventh District between a point off Point Conception and 35°N latitude.

Eleventh District. The Eleventh Coast Guard District has proposed the following recommendations for vessel traffic routing in the Santa Maria Basin area: 1) the existing TSS from Point Fermin to Pt. Conception is recommended to be extended in a northwesterly direction; 2) a new TSS would extend northward from a new Precautionary Area (described in 3, below) off Pt. Conception to latitude 35°00'N (where it would meet with the Twelfth District's routing scheme); and 3) a new Precautionary Area with a four nautical mile radius would connect the extension of the existing, generally

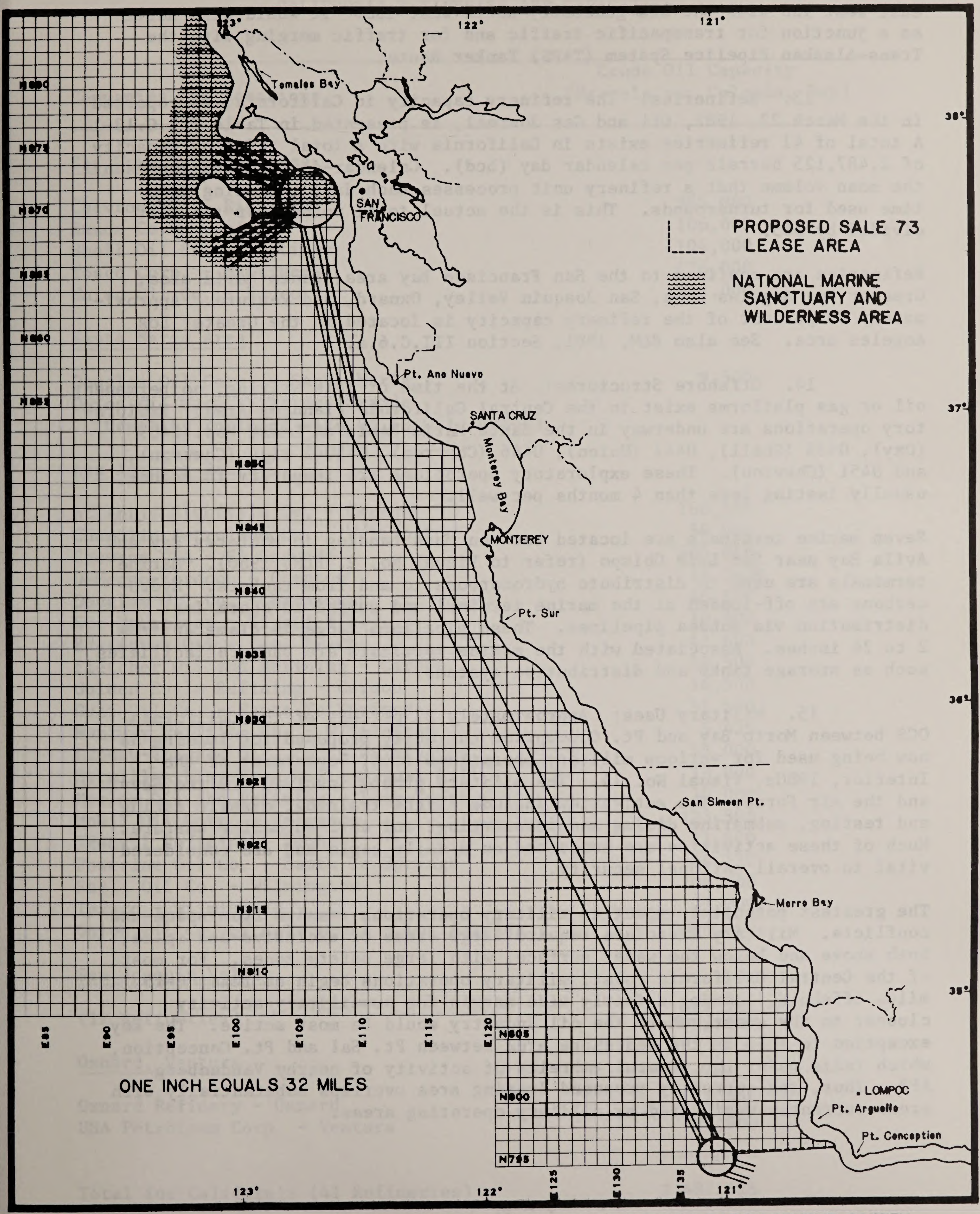


FIGURE III.C.12-1. COAST GUARD RECOMMENDED PORT ACCESS ROUTE, TRAFFIC SEPARATION SCHEME, SAFETY FAIRWAYS, AND PRECAUTIONARY AREAS OFF THE CENTRAL CALIFORNIA COAST.

east-west TSS with the new generally north-west TSS. It would also serve as a junction for transpacific traffic and for traffic merging with the Trans-Alaskan Pipeline System (TAPS) Tanker Route.

13. Refineries: The refinery capacity in California, as reported in the March 22, 1982, Oil and Gas Journal, is presented in Table III.C.13-1. A total of 41 refineries exists in California with a total refining capacity of 2,487,125 barrels per calendar day (bcd). Calendar-day numbers represent the mean volume that a refinery unit processes each day, including down time used for turnarounds. This is the actual total volume for the year divided by 365.

Refineries are confined to the San Francisco Bay area, Santa Maria area, Greater Los Angeles area, San Joaquin Valley, Oxnard, and Ventura. Approximately 60 percent of the refinery capacity is located in the Greater Los Angeles area. See also BLM, 1981, Section III.C.6.a.

14. Offshore Structures: At the time of this writing, no permanent oil or gas platforms exist in the Central California Planning Area. Exploratory operations are underway in the Santa Maria Basin on Lease Nos. 0409 (Oxy), 0435 (Shell), 0441 (Union), 0446 (Chevron), 0450-2 rigs (Chevron), and 0451 (Chevron). These exploratory operations are temporary in nature, usually lasting less than 4 months per well.

Seven marine terminals are located between Moss Landing in Monterey Bay and Avila Bay near San Luis Obispo (refer to Visual No. 2, BLM, 1980). Marine terminals are used to distribute hydrocarbons to and from tankers. Hydrocarbons are off-loaded at the marine terminal and pumped to shore for distribution via subsea pipelines. These pipelines range in diameter from 2 to 24 inches. Associated with the marine terminals are onshore facilities such as storage tanks and distribution systems.

15. Military Uses: Approximately 87 percent of the California OCS between Morro Bay and Pt. Conception currently proposed for leasing is now being used for various military operations (U.S. Department of the Interior, 1980a, Visual No. 1). The military groups involved are the Navy and the Air Force. The activities include flight training, missile firing and testing, submarine diving and transitting, and anti-submarine warfare. Much of these activities are conducted on a daily basis and are considered vital to overall national security.

The greatest potential impact to military operations results from space-use conflicts. Military exercises require large areas of exclusive-use space, both above and below the water surface, with large safety zones. For most of the Central California coast, military operations begin at least 6-15 miles offshore, leaving a fairly wide margin for nonmilitary activity closest to the coast, where the oil industry would be most active. The key exception to this is the nearshore area between Pt. Sal and Pt. Conception, which falls under the general umbrella of activity of nearby Vandenberg AFB. Thus, the currently proposed leasing area overlaps substantially with areas currently designated as military operating areas.

TABLE III.C.13-1
CALIFORNIA REFINERIES AND CAPACITIES

Companies and Locations	Crude Oil Capacity (Barrels per Calendar Day)
San Francisco Bay Area	
Chevron USA - Richmond	365,000
Exxon Co. - Benicia	106,000
Shell Oil Co. - Martinez	104,000
Tosco Corp. - Martinez	126,000
Union Oil Co. - Rodeo	111,000
Santa Maria Area	
Douglas Oil Corp. - Santa Maria	9,500
Union Oil Corp. - Arroyo Grande (Capacity included with Union Oil, Rodeo)	
Los Angeles Basin	
Atlantic Richfield Co. - Carson	166,000
Champlin Petroleum Co. - Wilmington	60,000
Chevron USA - El Segundo	405,000
DeMenno-Kerdoon - Compton	14,250*
Douglas Oil Co. - Paramount	46,500
Eco Petroleum - Signal Hill	10,000
Edgington Oil - Long Beach	41,600
Fletcher Oil and Refining - Carson	29,500
Golden Eagle Refining - Carson	16,500
Gulf Oil Co. - Santa Fe Springs	51,500
Huntway Refining Co. - Wilmington	5,425
Lunday-Thagard Oil. Co. - Wilmington	15,000
Macmillan Ring-Free Oil - Signal Hill	13,000
Marlex Oil and Refining - Long Beach	20,000
Mobil Oil Corp. - Torrance	123,500
Newhall Refining - Newhall	21,400
Powerine Oil Co. - Santa Fe Springs	44,120
Shell Oil Co. - Wilmington	108,000
Texaco - Wilmington	75,000
Union Oil Co. of California - Los Angeles	108,000
San Joaquin Valley	
(12 Refineries)	259,430
Oxnard, Ventura	
Oxnard Refinery - Oxnard	4,000
USA Petroleum Corp. - Ventura	27,900
Total for California (41 Refineries)	2,487,125

*Converted from Barrels per Stream Day

Source: Oil and Gas Journal, 22 March 1982, Annual Refining Survey

ENVIRONMENTAL CONSEQUENCES

IV.

IV. ENVIRONMENTAL CONSEQUENCES

A. Information Used in Impact Analysis

1. Resource Estimates: Resource estimates used for analysis of the potential environmental impacts from Alternatives I are discussed in detail in Section II.A.1.b. The estimated resources for the Central and Northern California and Southern California Planning Areas are listed in Table IV.A.1-1. Table IV.A.1-1 also presents information on the Southern California Reserves.

2. Exploration and Development Assumptions: Proposed Sale No. 73 would lead to the exploration for and the potential development and production of oil and gas resources. The oil and gas operations (pre-lease) would begin with geophysical surveys and geological sampling programs designed to study the age, structure, and hydrocarbon potential of the area. Shallow core holes, bottom sampling, and deep stratigraphic test holes would be drilled to provide additional geologic and geochemical information.

After leasing, exploratory (wildcat) wells would be drilled by industry on the best petroleum prospects as suggested by the geological and geophysical data in order to locate, delineate, and characterize hydrocarbon reservoirs. These wells are drilled from semi-submersibles, jackups, and drillships. All three are assumed in this analysis. If commercially productive reservoirs are located, development wells are normally drilled from fixed platforms. These wells include production wells and a variety of service wells which increase the productivity of the field. Subsea completion systems may also be used. The exploration, development and production phases of oil operations require docking and onshore equipment storage, service facilities, helicopters, and attendant facilities. The development and production phase also requires offshore and onshore hydrocarbon storage and processing facilities as well as pipeline and/or deepwater tanker ports (marine terminals).

The analysis made in this document is based on the Most Likely Resource Estimates (Section II.A.1.b); associated development (Section II.A.1.c); and Transportation Scenario No. 1 (Yamasaki, 1983).

Using these development timetables, resource estimates, and transportation scenarios, the following further development assumptions were made by MMS: 1) No petroleum refineries are expected to be constructed in California as a result of the proposed sale. (However, modifications (i.e., retrofitting) to the refining process will be required in order to process heavy, sour crude oil); 2) Pipelines as described in the Transportation Scenario No. 1 would be constructed; 3) Certain levels of formation water, drilling muds and cuttings, etc., would be discharged into the marine environment as a result from the proposed sale (these items are detailed in Table IV.A.8.a-1; and 4) Onshore facilities (i.e., oil and gas treating facilities, crude oil storage tanks, supply and crew boat bases, and temporary support facilities) would be required, according to Transportation Scenario No. 1. The environmental consequences are based on all these assumptions.

TABLE IV.A.1-1

RESOURCE ESTIMATES FOR THE CENTRAL AND NORTHERN; AND SOUTHERN CALIFORNIA PLANNING AREA (CONDITIONAL MEAN)

	Billion Barrels of Oil	Trillion Cubic Feet of Gas
Central and Northern Resource Estimate (Excludes tracts leased in OCS Sale No. 53)	1.23	1.53
Santa Maria Basin (Tracts leased in OCS Sale No. 53)	0.163	0.163
Southern California Reserves	0.86	1.73
Southern California Resource Estimate (Tracts leased in previous sales)	0.29	0.57

Many variables would affect the types and locations of facilities that would be required to support the exploration, development, and production of oil and gas resources, if discovered. A number of facility combinations are possible. Among these variables are the policies and controls of local, regional, State and Federal governments, and of private (land rights), corporate, institutional, and industrial landholders.

Proposed Sale No. 73 is assumed to use certain facilities developed or expected to be developed as a result of existing Federal and State leases issued during the last 20-30 years. This could include sharing of pipelines (offshore and onshore), onshore operations bases, and certain platform facilities. All site-specific facilities developed for any Sale would be subject to all existing Federal, State, and local regulations, land use plans, policies, controls, etc.

3. Projected Transportation and Markets: Resource supply, production, development, and transportation assumptions are based on the Most Likely Resources Estimate of oil and gas (Table II.A.1.b-1). Proposed Sale No. 73 crude production is expected to be refined in San Francisco, Los Angeles, and Gulf of Mexico area (Galveston) refineries.

The following discussion details what are considered the most likely oil and gas transportation methods. This discussion briefly summarizes Transportation Scenario No. 1 (Yamasaki, 1983). For a more detailed discussion of this transportation scenario, see Yamasaki (1983). The scenarios are a hypothetical framework of assumptions and estimates on the amount, timing and general locations for OCS exploration, development, and production activities and facilities. These scenarios were developed for the purpose of analysis in this impact document. The assumptions and estimates that are made in the scenarios incorporate information from historical trends, industry, Federal, State and local government planning, geologic information and present technology. The resulting implementation of the activities assumed in the scenarios can only be ascertained after leasing occurs and production of the resources commences.

Oil and gas production from the proposed sale area would be transported to shore via subsea pipeline. It is assumed that oil and gas production from two proposed platforms located in the northern portion of the proposed sale area would come ashore via subsea pipeline near existing oil and gas treatment facilities at Nipomo Mesa. Processed oil would be transported from this facility (assumed to have existing treatment facilities) to Gaviota* (in the Santa Barbara Channel) via an onshore pipeline that is assumed to be constructed as a result of previous lease sales. Gas would be treated at the Nipomo Mesa facility and would be transported via an assumed to be constructed onshore pipeline to the existing Southern California Gas Co. pipeline near Gaviota. Oil and gas production from three proposed platforms located in the southern portion of the Santa Maria Basin would be transported via an offshore pipeline to shore near Point Conception. From Point Conception, hydrocarbons would be transported via assumed existing onshore pipelines to Gaviota. Assumed existing treatment plants, onshore storage tanks and an offshore marine terminal would be at Gaviota. These facilities are currently being considered by the Petroleum Transportation Committee (Petroleum Transportation Committee, 1982). Oil would be transported from the Gaviota facility as follows:

*Gaviota is one of the several Santa Barbara terminal sites presently under consideration by MMS. The selection of Gaviota as a terminal site for Proposed Sale No. 73 does not flex MMS's decision on the possible site for the Santa Barbara terminal.

1) 50 percent of the oil would go to Los Angeles area refineries via an onshore pipeline (this pipeline is presently being considered by the Petroleum Transportation Committee (PTC, 1982)); 2) 25 percent of the oil would be tankered from the Gaviota marine terminal north to the San Francisco Bay area refineries; and 3) the remaining 25 percent of the produced oil would be tankered to the Gulf of Mexico area refineries (Galveston, Texas) via the Panama Canal. Gas would be transported via an onshore pipeline to the existing Southern California Gas Company pipeline. A helicopter base and supply boat base at Gaviota is assumed to be constructed would be used to service the five platforms in the Santa Maria Basin. In addition, helicopter bases exist near San Luis Obispo (SLO) (SLO Co. Airport) and Santa Maria (Santa Maria Airport). A crew boat base at Avila Bay (Port San Luis) would be built to support hydrocarbon operations in this area.

California refineries (Los Angeles and San Francisco Bay area) are assumed (Yamasaki, 1983) to have the capacity and would process all the Proposed Sale No. 73 crude oil that is shipped or piped to them. The total capacity of the California refineries is 2.5 million bbls. These refineries were operating at only 62 percent capacity during the second quarter of 1982. No new refineries are proposed or expected; however, since much of the Proposed Sale No. 73 crude oil is anticipated to be heavy (low API) and high in sulphur content, then expensive modifications (i.e., retrofitting) to the refinery process would be needed.

California OCS oil and gas has found, and will likely continue to find, a variety of intermediate and final product uses. The particular composition of final uses that might result from oil and gas produced in the region depends on institutional and economic relationships that would evolve during the life of the project. Generally, products of California refineries are consumed within the State, though Nevada and Arizona are also logical markets. In addition, there are numerous markets for any from Proposed Sale No. 73 crude that is refined on the Gulf Coast, for example, the southern and eastern United States.

4. Oil Spills

a. Oil Spill Risk Analysis Model: Oil spills are considered one of the single greatest potential impacting agents to the environment from offshore oil and gas activities. Oil spills can potentially impact resources ranging from biologically sensitive habitats and endangered species to recreational beaches or military operating areas. As a result, the U.S. Department of the Interior Geological Survey (USGS) has developed the Oil Spill Risk Analysis Model (LaBelle, et al., 1982; Smith, et al., 1982; Lanfear, et al., 1979) as a tool to aid in the overall understanding of the potential risk of oil spills to the environment from specific offshore oil and gas lease sales.

The model is a means of quantifying the potential risks of oil spills resulting from the proposed action, as well as from existing leases and oil imports. An understanding of the uncertainties and assumptions about both the data used as input to the model and the resultant output data is necessary in order to make the subsequent analyses meaningful.

The model assumptions include: 1) seasonally averaged oceanic surface currents and average winds can be used to assess the probable trajectories of floating

oil; 2) reasonable resource estimates can be made from knowledge of the general geologic formations where in some cases no test wells have been drilled; 3) the best estimate of what may happen in the future in terms of accident/oil spill rates can be based on past U.S. OCS activity and world tankering; 4) the best exposure variable for risk assessment in all activity modes (platforms, tankers, and pipelines) is production volume. The oil spill model is described in more detail in the reports mentioned above and briefly below.

Model Description. For this sale, the model study area (from the Washington-Oregon State line to the Mexican border) is overlaid with a 420 by 590 grid system, allowing a resolution of approximately 2-3 km of coastline. This shoreline is broken up into 65 land segments of 32-48 km long (20-30 miles) (Figure IV.A.4-1). This aids in the analysis of specific coastal areas where estuaries, harbors, or beaches may be located. Resources are selected, either at sea or onshore, as areas of key concern for use as "targets" of simulated spills (Figure IV.A.4-2). These targets can be designated vulnerable year-round or only during certain months, to account for migrating birds, for example. The proposed leasing area offshore is divided into 17 oil spill launch areas of roughly 16-20 lease tracts each. Oil spills are simulated from these launch areas as well as from existing lease areas in Southern and Central California (Figures IV.A.4-3, 4). Simulated oil spills are also launched from along the proposed and existing tanker and pipeline routes in the study area. These tanker routes include foreign and Alaskan import crude tankering within the study area.

There are, however, an unknown additional number of oil spills, not accounted for by the model, expected to occur from development of oil and gas resources in State tidelands and from other general vessel traffic in the study area. Several transportation scenarios are considered (Yamasaki, 1983). The most likely transportation scenario is incorporated into the model.

The model keeps track of "hits" to both targets and land segments, simulating 2,000 spills (500 per season) from each launch area and along each transportation route. Simulated oil spill model runs may terminate when the spill contacts land, crosses a model boundary, or remains at sea more than 30 days.

The driving forces for moving a spill are surface ocean currents and winds. The surface ocean currents were obtained from the Dynalysis of Princeton model of circulation of the California Shelf (A.F. Blumberg, et al., 1982 - Interim Report). The oceanographic data used in the Dynalysis study come frlm the National Oceanographic Data Center (NODC) and the California Cooperative Fisheries Investigation (CalCOFI), and are current through 1979.

To obtain the oil spill movement the model uses 3.5 percent of the wind speed, rotated a variable angle (0°-20°) to the right depending on this speed (Samuels, W.B., et al., 1982). This vector is then added to the surface current velocity vector. Long-term wind data observed from four coastal stations: Monterey, Vandenberg, San Nicolas Island, and San Diego, (compiled by the National Climatic Center, Asheville, NC), and one offshore buoy off Oregon are used to to construct seasonal transition matrices which are sampled using a random (Monte Carlo) technique.

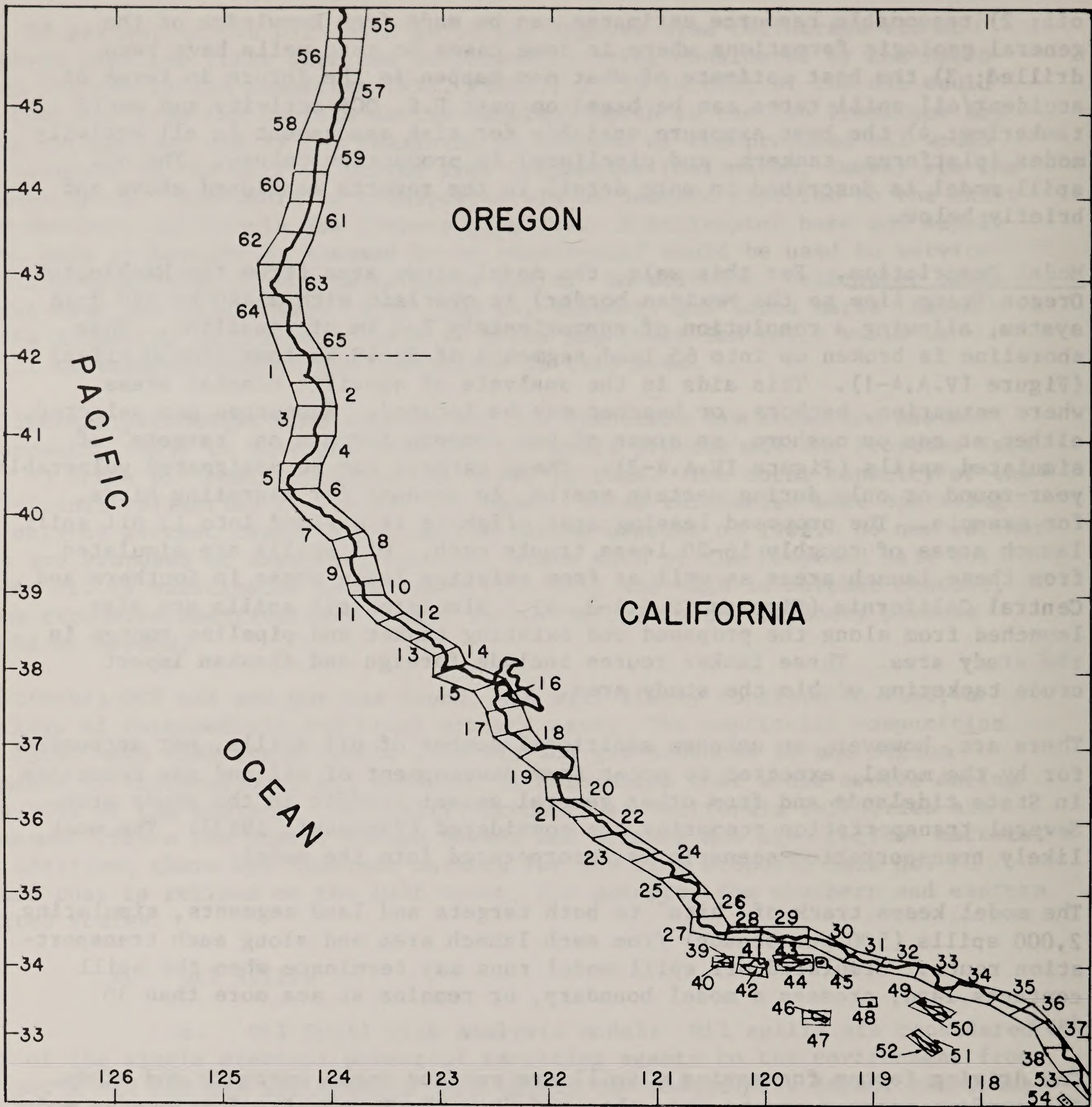


FIGURE IV. A. 4-1 MAP SHOWING THE DIVISION OF THE OREGON AND CALIFORNIA SHORELINES INTO 65 SEGMENTS OF APPROXIMATELY EQUAL LENGTHS.

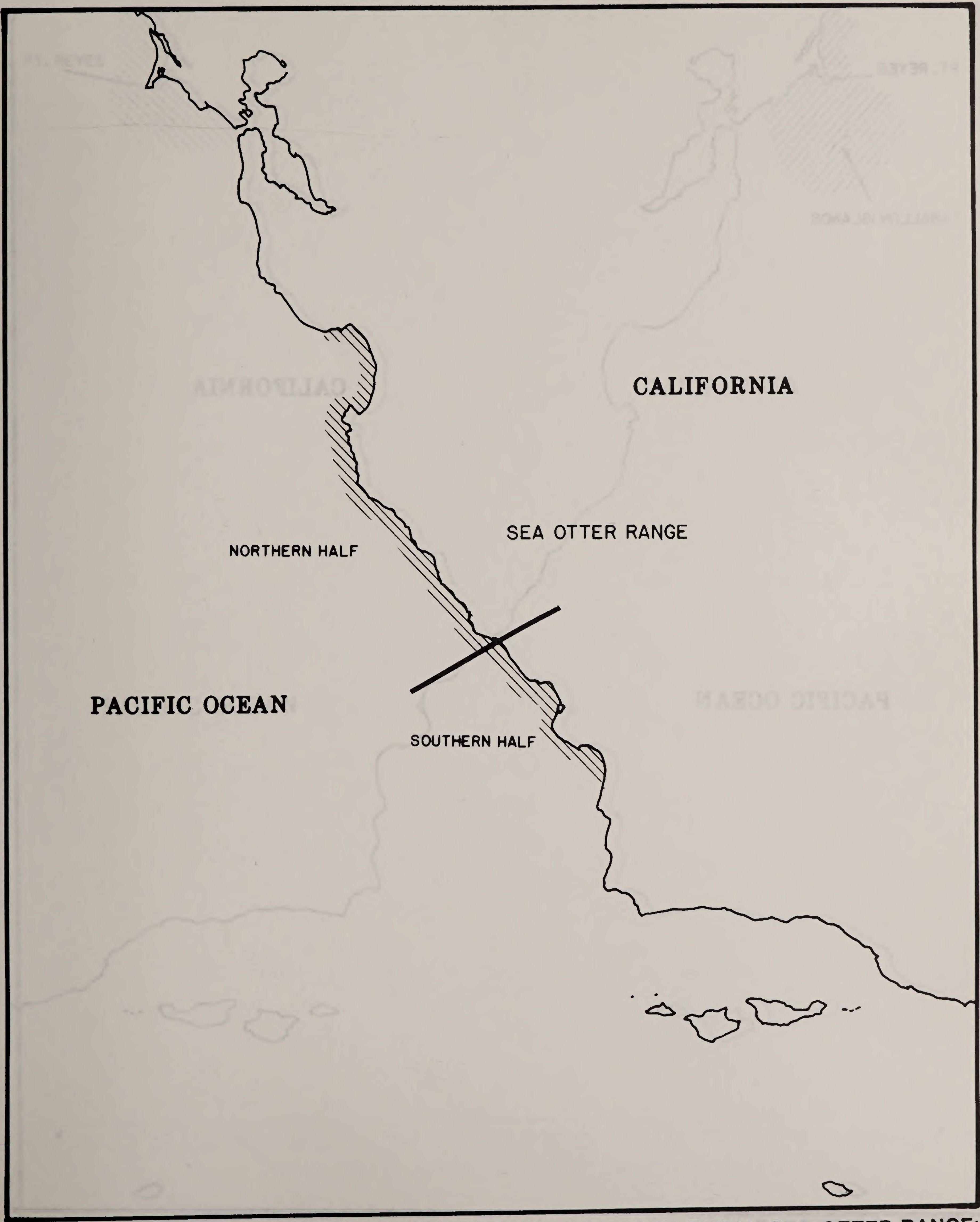


FIGURE IV.A.4-2 MAP SHOWING THE OIL SPILL MODEL TARGETS: TOTAL SEA OTTER RANGE; SEA OTTER RANGE NORTHERN HALF; SEA OTTER RANGE SOUTHERN HALF.

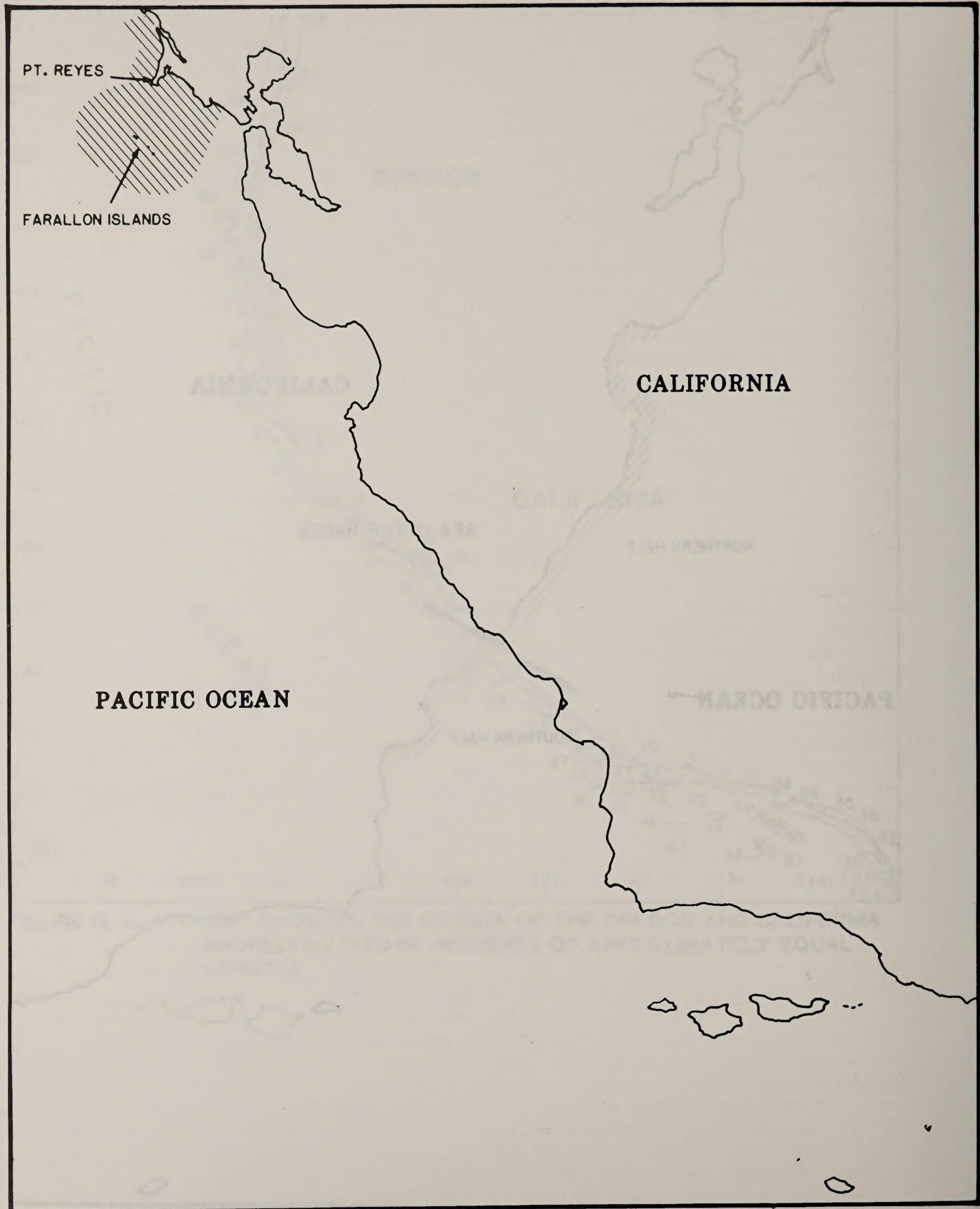


FIGURE IV.A.4-2 (CONT.) MAP SHOWING THE OIL SPILL MODEL TARGET: PT. REYES-FARALLON ISLANDS NATIONAL MARINE SANCTUARY.

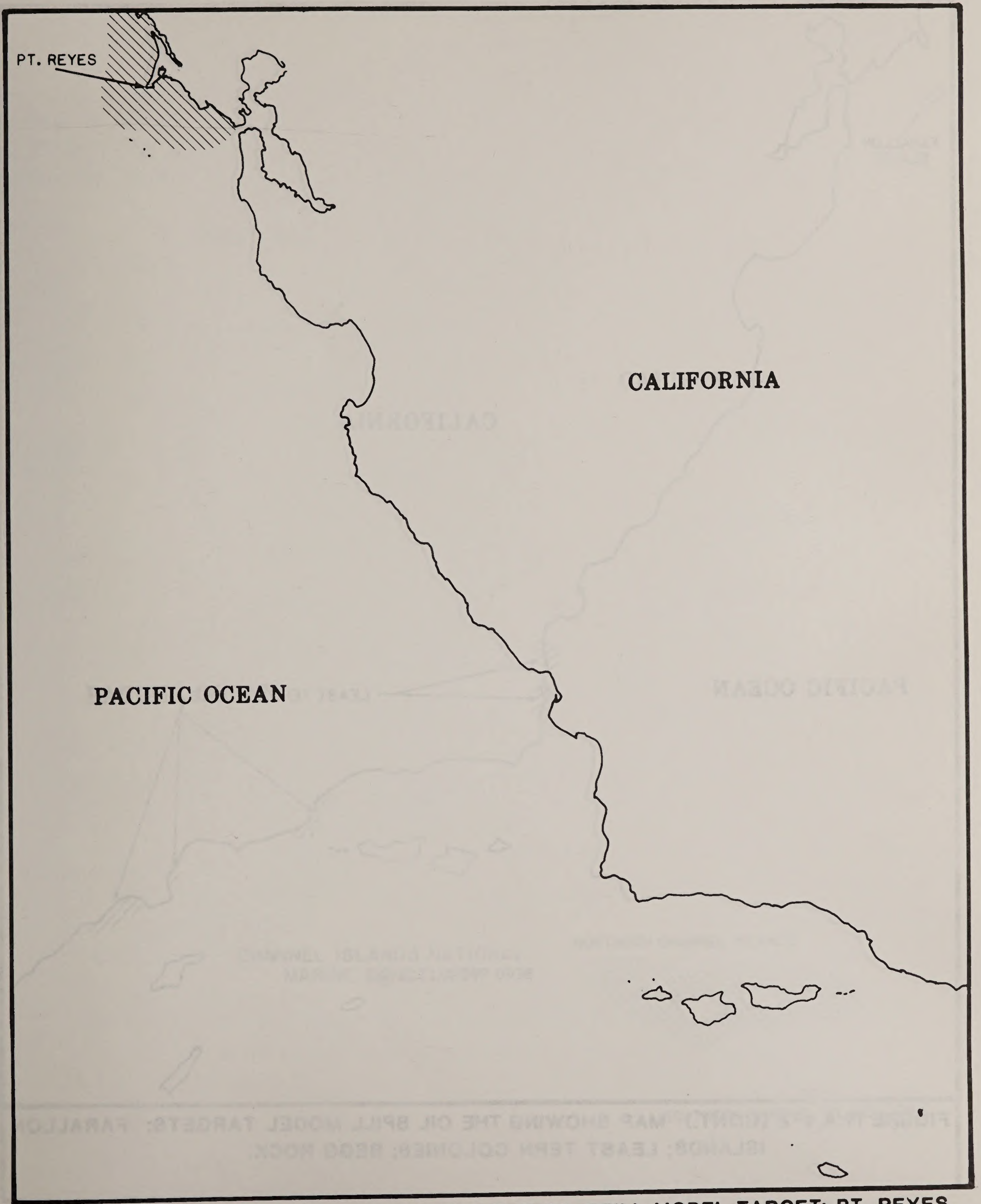


FIGURE IV.A.4-2 (CONT). MAP SHOWING THE OIL SPILL MODEL TARGET: PT. REYES WILDERNESS AREA.

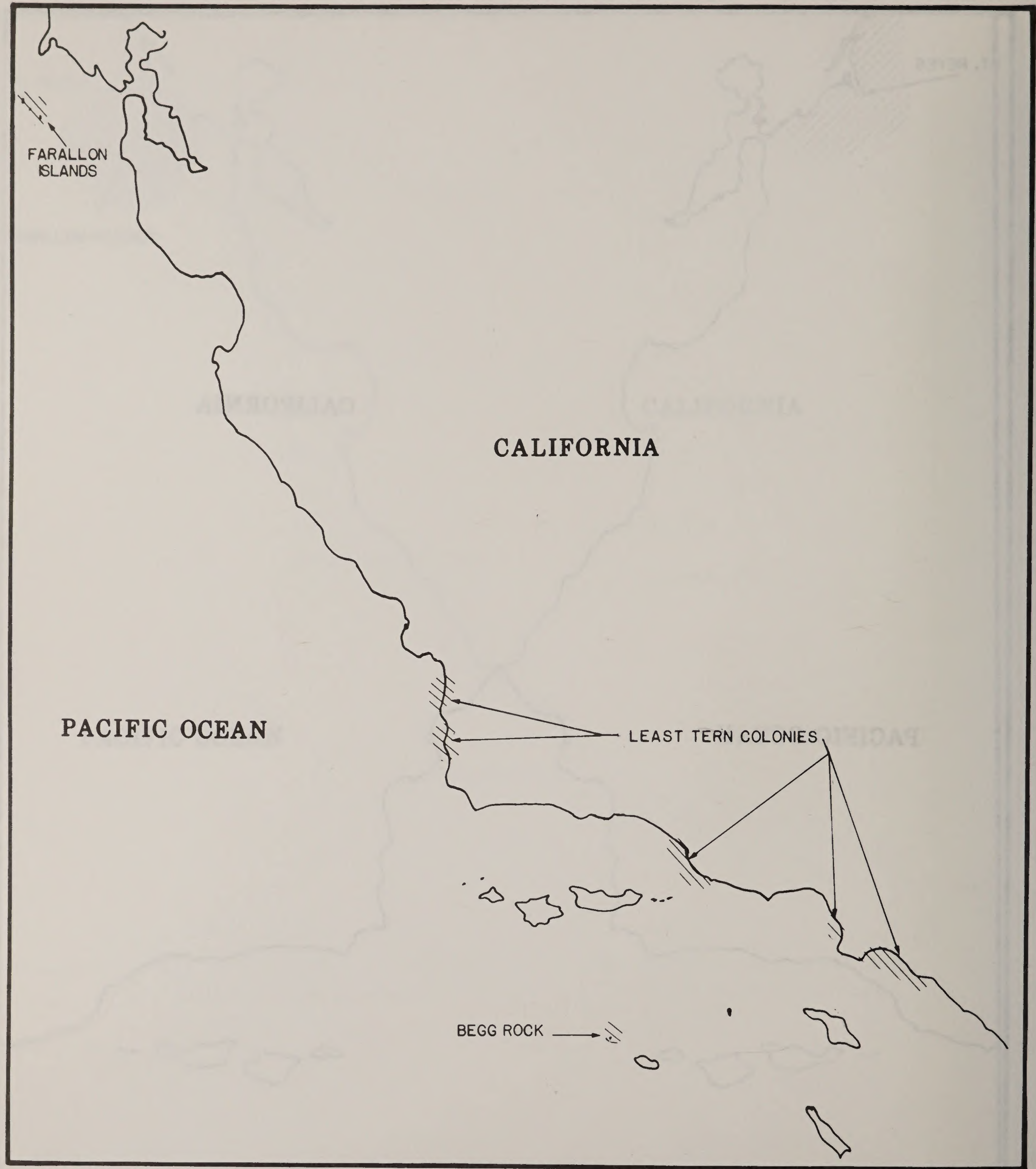


FIGURE IV.A.4-2 (CONT.) MAP SHOWING THE OIL SPILL MODEL TARGETS: FARALLON ISLANDS; LEAST TERN COLONIES; BEGG ROCK.

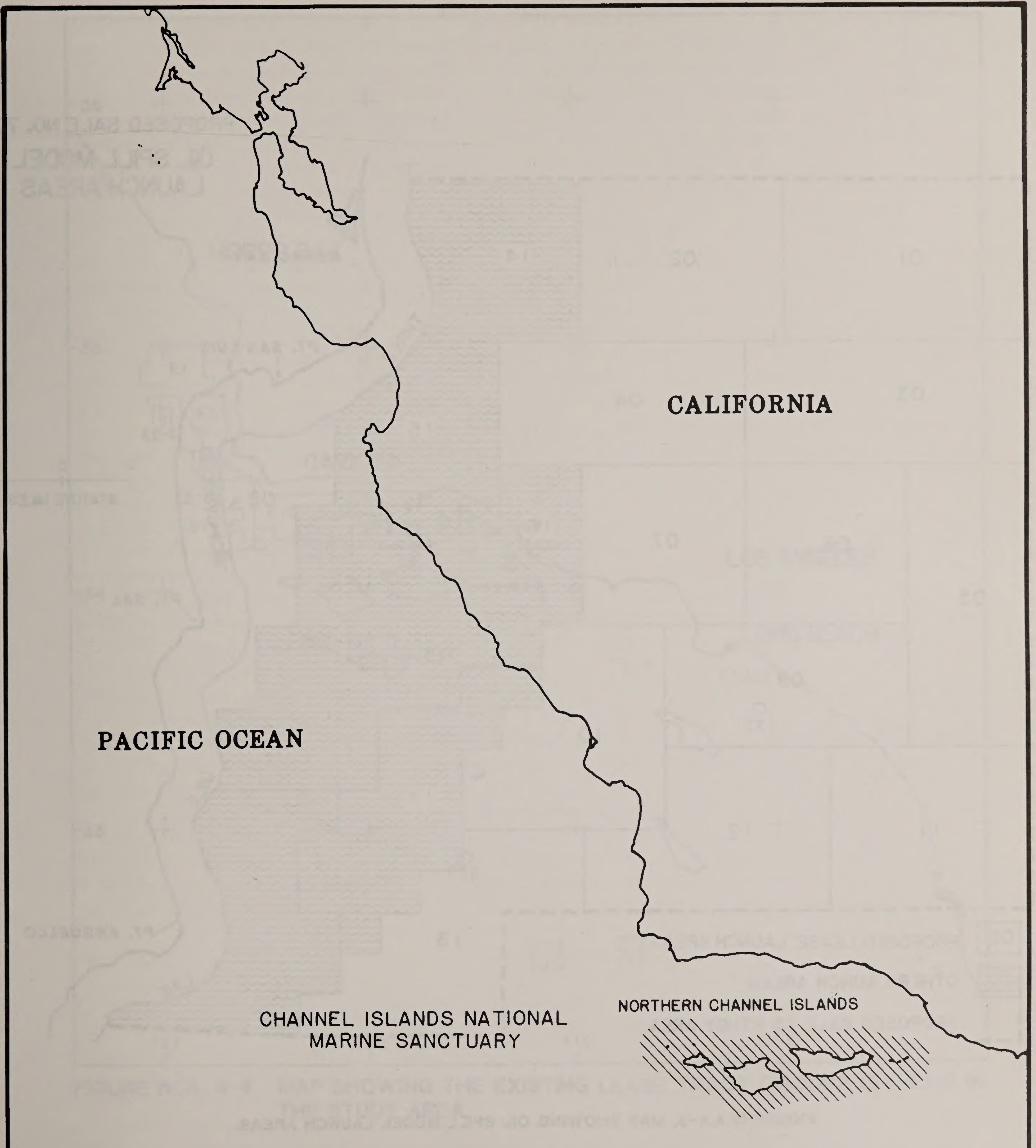


FIGURE IV.A.4-2. (CONT.) MAP SHOWING THE OIL SPILL MODEL TARGETS: CHANNEL ISLANDS NATIONAL MARINE SANCTUARY; NORTHERN CHANNEL ISLANDS (6-MILE PERIMETER); SOUTHERN CHANNEL ISLAND (6-MILE PERIMETER) AROUND SANTA BARBARA ISLAND).

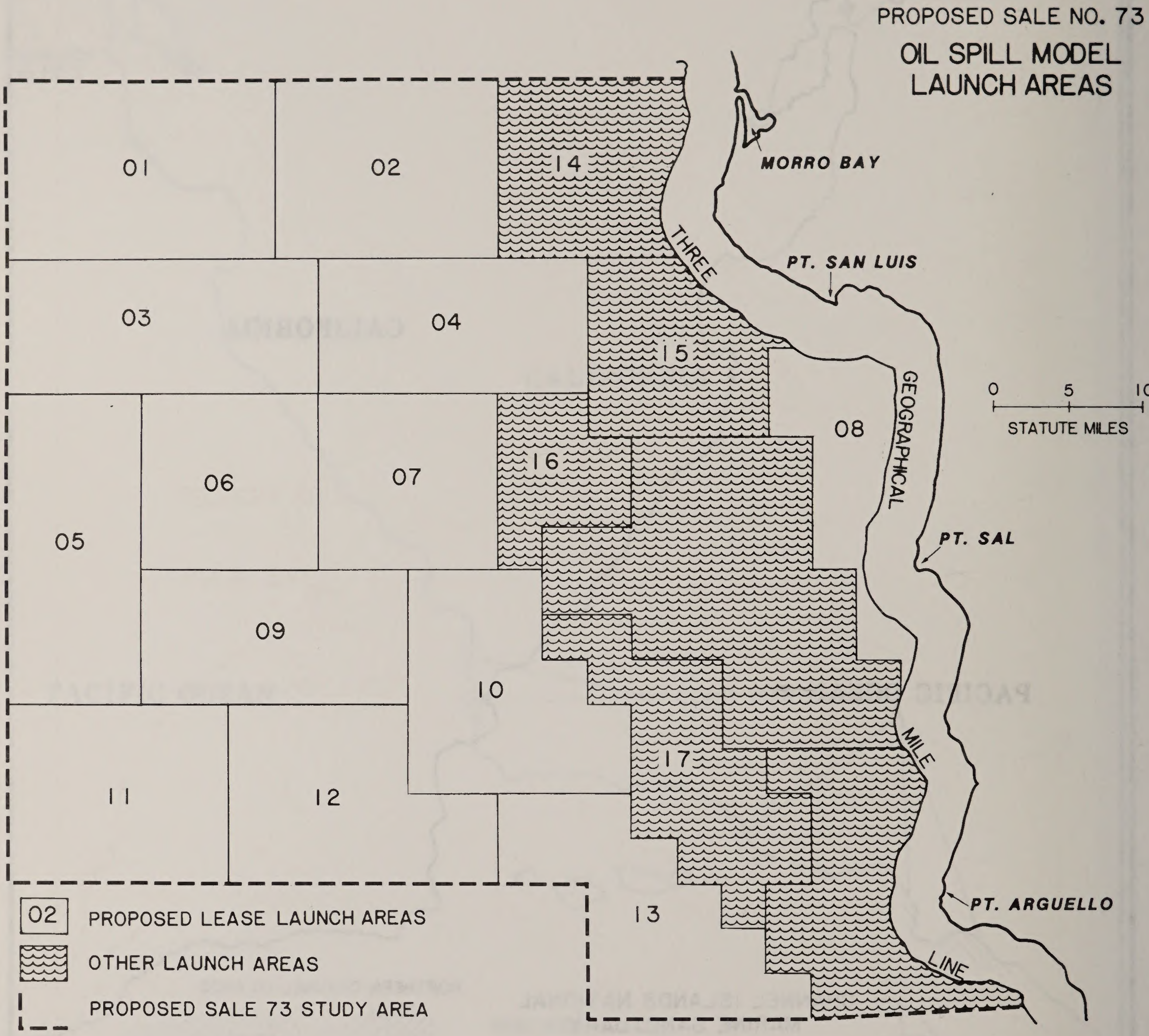


FIGURE IV.A.4-3. MAP SHOWING OIL SPILL MODEL LAUNCH AREAS.

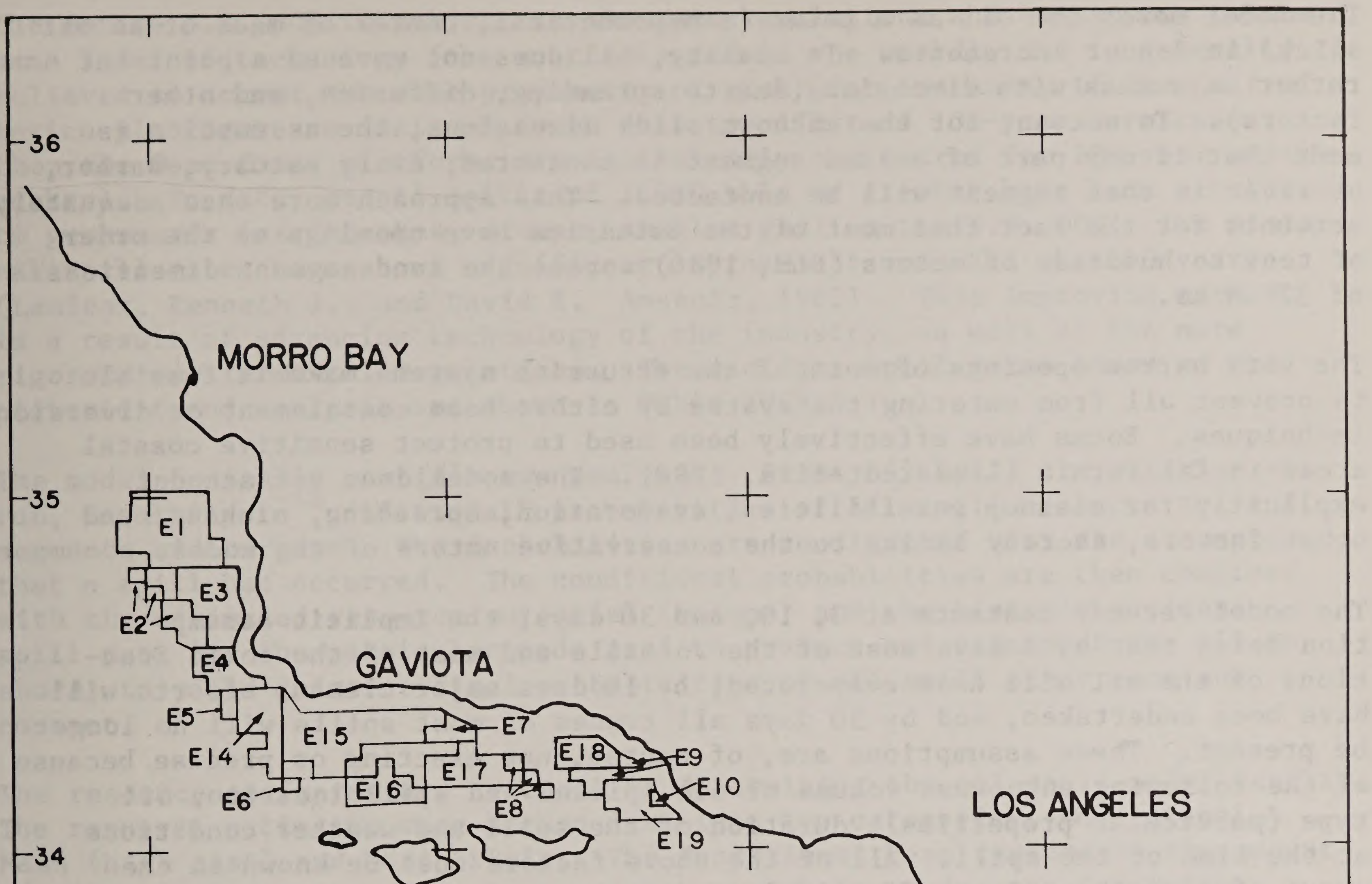


FIGURE IV.A. 4-4 MAP SHOWING THE EXISTING LEASE TRACT GROUPS (E1-E23) IN THE STUDY AREA.

The model moves the oil as a point (a hypothetical, center of mass of an oil slick) in 3-hour increments. In reality, oil does not move as a point but rather as a mass with dimension (due to spreading, diffusion, and other factors). To account for the unknown slick dimensions, the assumption is made that if any part of a land segment is contacted, every estuary, harbor, or river in that segment will be contacted. This approach more than adequately accounts for the fact that most of the estuaries have openings on the order of tens to hundreds of meters (BLM, 1980) versus the land segment dimensions of 32-48 km.

The very narrow openings of most of the estuarine systems make it feasible to prevent oil from entering the system by either boom containment or diversion techniques. Booms have effectively been used to protect sensitive coastal areas in California (Lindstedt-Siva, 1980). The model does not account explicitly for cleanup possibilities, evaporation, spreading, sinking, and other factors, thereby adding to the conservative nature of the model.

The model records contacts at 3, 10, and 30 days; the implicit assumption being that by 3 days most of the volatile and most of the toxic fractions of the oil will have evaporated, by 10 days major cleanup efforts will have been undertaken, and by 30 days all traces of most spills will no longer be present. These assumptions are, of course, not exacting or precise because of the following unknowns: volume of oil spilled and spill location, oil type (particular properties), duration of the spill and weather conditions at the time of the spill. All of the above factors must be known in the event of a real spill to effectively undertake a cleanup operation and predict the most likely land fall.

The model categorizes spills in three volume classes: greater than or equal to 1,000 bbls, 1,000-10,000 bbls, and greater than or equal to 10,000 bbls. Spills that occur are often in the range of 50-1,000 bbls, and are usually the result of transferring of lightering operations, and are reported a lower percentage of the time than larger spills. This size class of spills is also lost quickly to the environment, and occurs most often near port where cleanup capabilities are best. Although these processes will act on spills of all sizes, spills of the smaller size classes will respond quickest to natural forces and cleanup efforts and often will not be discernable within a very short amount of time.

Another important assumption the model makes is that historical oil spill accident rates can be used to predict the future spills. The accident data are separated into three modes: production (platforms), pipelines, and tankers. It is very important to consider oil and gas transport as well as production, since actual production is just one part of the process subject to possible oil spills and environmental risk. The historical spill rates from U.S. OCS activity are used to extimate spills from production (platforms) and pipelines and the world tankering rate is used to estimate spills from tanker transportation (as the model includes risk from import tankering). The model assumes that 50 percent of the spills from tankers will occur in the study area if the tanker makes only a single port call in the study area. The historical spill rates for platforms and pipelines come from both the Gulf of Mexico and Southern California, where all Federal offshore production has so far taken place.

The entire U.S. OCS is subject to the same regulations and has access to the same level of technology (the most advanced in the world), and is generally believed to accept the same propensity of risk (for instance, if the Gulf of Mexico platforms are designed to be able to withstand 100-year hurricanes, then the West Coast platforms are equivalently engineered for 100-year earthquakes). To date, no oil spills of 1,000 bbls or greater have been attributed to geohazards (earthquakes, slumps, shallow gas) on the U.S. OCS. The historical spill rates have shown significant improvement over the past 10 years (Lanfear, Kenneth J., and David E. Amstutz, 1982). This improving record is a result of advancing technology of the industry, as well as the more rigorous environmental regulations. The accident spill rates based on the historic trend analysis are shown in Table IV.A.4-1.

The model basically combines two analyses. First oil spill trajectories are run, resulting in "conditional" probabilities of oil spill contacts to land segments and targets. The probabilities are conditioned with the assumption that a spill has occurred. The conditional probabilities are then combined with the estimated resource potential (volume) and the historic accident spill rate for the particular mode used to produce and transport the oil to shore, to yield joint or final probabilities of oil spill occurrence and contact.

The resource estimates are critical in determining the oil spill model results. The resource estimates were broken down into two categories, Conditional Mean (high case) and Most Likely. The Conditional Mean represents the amount of oil and gas predicted to be found for the whole study area (excluding state waters) if any oil and gas is actually present. It is a "full development" or high case estimate and includes resources expected to be found as a result of this sale and future sales. The Most Likely estimate is 30 percent of the Conditional Mean, representing the amount of resources expected to be found and developed as a result of Proposed Sale No. 73. The analyses done for this report are based on the Most Likely estimates, with a comparison done with the Conditional Mean estimate.

It is important to keep in mind that oil spill "contact" does not imply oil spill "impact", as does lack of contact not imply no impact, (i.e., fish may be impacted during an oil spill even though no oil has contacted any shoreline areas). "Impact" analyses are discussed in the specific sections concerning that particular resource, where the analyst considers the particular resource characteristics when determining impacts from oil spills.

Oil Spill Model Results. This model attempts to predict what is likely to occur given the large state of uncertainty of such factors as the resource estimates, transportation scenarios, wind and current conditions, changing industry technology, changing economic conditions and subsequent oil and gas prices and demand, and political climate. For example, of the 218 tracts offered in Proposed Sale No. 68 (Southern California) only 29 actual leases were issued as a result of the sale (June 11, 1982).

The actual environmental risk may prove significantly higher or lower than discussed in this report. Table IV.A.4-2 is a summary of the oil spill model results, and Appendix F shows some of the oil spill model data for both the resource targets and land segments in more detail. The very conservative attitude was taken in the analyses by assuming that a 25 percent

TABLE IV.A.4-1

ACCIDENT SPILL RATE (Spills Per Billion Barrels)

(based on Landfear and Amstutz 1983

Mode	$\geq$ 1,000 bbls	1,000-10,000 bbls	$\geq$ 10,000 bbls
Platforms	1.00	0.56	0.44
Pipelines	1.60	0.93	0.67
Tankers	1.30	0.65	0.65

TABLE IV.A.4-2

OIL SPILL OCCURRENCES EXPECTED FROM PROPOSED SALE NO. 73, EXISTING FEDERAL LEASES AND IMPORTED OIL TRANSPORTATION SOURCES WITHIN THE STUDY AREA

	Expected Number of Spills (and probabilities) by spill volume (bbls)					
Total for proposed Sale No. 73	$\geq$ 1,000 (probability)		1-10,000 (probability)		$\geq$ 10,000 (probability)	
Most Likely	0.90	(59%)	0.50	(39%)	0.40	(33%)
Conditional Mean	3.00	(95%)	1.67	(81%)	1.32	(73%)
Existing Federal Leases	3.41	(88%)	1.95	(71%)	1.46	(77%)
Tanker Transportation Crude Oil Imports (total)	4.96	(99%)	2.52	(92%)	2.52	(92%)
Alaskan	3.98	(98%)	2.02	(87%)	2.02	(87%)
from foreign sources	0.98	(62%)	0.50	(39%)	0.50	(39%)

The entire U.S. OCS is subject to the same regulations and has access to the same level of technology (the most advanced in the world), and is generally believed to accept the same propensity of risk (for instance, if the Gulf of Mexico platforms are designed to be able to withstand 100-year hurricanes, then the West Coast platforms are equivalently engineered for 100-year earthquakes). To date, no oil spills of 1,000 bbls or greater have been attributed to geohazards (earthquakes, slumps, shallow gas) on the U.S. OCS. The historical spill rates have shown significant improvement over the past 10 years (Lanfear, Kenneth J., and David E. Amstutz, 1982). This improving record is a result of advancing technology of the industry, as well as the more rigorous environmental regulations. The accident spill rates based on the historic trend analysis are shown in Table IV.A.4-1.

The model basically combines two analyses. First oil spill trajectories are run, resulting in "conditional" probabilities of oil spill contacts to land segments and targets. The probabilities are conditioned with the assumption that a spill has occurred. The conditional probabilities are then combined with the estimated resource potential (volume) and the historic accident spill rate for the particular mode used to produce and transport the oil to shore, to yield joint or final probabilities of oil spill occurrence and contact.

The resource estimates are critical in determining the oil spill model results. The resource estimates were broken down into two categories, Conditional Mean (high case) and Most Likely. The Conditional Mean represents the amount of oil and gas predicted to be found for the whole study area (excluding state waters) if any oil and gas is actually present. It is a "full development" or high case estimate and includes resources expected to be found as a result of this sale and future sales. The Most Likely estimate is 30 percent of the Conditional Mean, representing the amount of resources expected to be found and developed as a result of Proposed Sale No. 73. The analyses done for this report are based on the Most Likely estimates, with a comparison done with the Conditional Mean estimate.

It is important to keep in mind that oil spill "contact" does not imply oil spill "impact", as does lack of contact not imply no impact, (i.e., fish may be impacted during an oil spill even though no oil has contacted any shoreline areas). "Impact" analyses are discussed in the specific sections concerning that particular resource, where the analyst considers the particular resource characteristics when determining impacts from oil spills.

Oil Spill Model Results. This model attempts to predict what is likely to occur given the large state of uncertainty of such factors as the resource estimates, transportation scenarios, wind and current conditions, changing industry technology, changing economic conditions and subsequent oil and gas prices and demand, and political climate. For example, of the 218 tracts offered in Proposed Sale No. 68 (Southern California) only 29 actual leases were issued as a result of the sale (June 11, 1982).

The actual environmental risk may prove significantly higher or lower than discussed in this report. Table IV.A.4-2 is a summary of the oil spill model results, and Appendix F shows some of the oil spill model data for both the resource targets and land segments in more detail. The very conservative attitude was taken in the analyses by assuming that a 25 percent

probability or greater of one or more spills occurring and contacting land segments or targets implies a high probability and therefore is expected.

AREAS OUTSIDE THE PROPOSED SALE AREA

Oregon. The oil spill risk analysis model was run for all the California and Oregon OCS. This model used the Dynalysis of Princeton Model, which was run for the entire U.S. West Coast (and most of Baja California), as input for ocean circulation (currents), and included a wind buoy offshore Oregon for the wind data for the northern wind province. The oil spill model included 11 land segments covering the entire Oregon coast (segments #55-65). The results of the model show an expected number of zero spills greater than or equal to 1000 bbls, with a less than .05 probability of one or more spills occurring and and contacting any of the Oregon land segments in any time frame (3, 10, or 30 days), as a result of the proposal. The model did show, however, a very small risk (up to 0.2 spills) to the Oregon segments due to import tankering of crude oil from Alaska going to California refineries. Overall, no oil spill impacts are expected to the Oregon coast from the Proposed Lease Sale No. 73.

California Coast North of the Proposed Sale Area. The oil spill model predicts virtually no spills occurring and contacting any of the land segments north of the proposed sale area.

Santa Barbara Channel. The Santa Barbara Channel includes the northern Channel Islands, an area of critical ecological concern. The Channel Islands National Marine Sanctuary which includes a 6-mile buffer zone around the northern islands and a 6-mile buffer around Santa Barbara Island was designated as a "target" to the oil spill risk analysis model (actually 3 targets-total, Channel Islands, northern Channel Islands, southern Channel Islands (Santa Barbara Island)). The model predicts one spill will occur and contact the northern Channel Islands target (probability 0.26 of large spill occurring and contacting within 30 days) from the Proposed Lease Sale No. 73.

The model also idicates a risk of oil spills to the Channel Islands from existing oil and gas activity in the area (from previous lease sales) and from import crude oil tankering (both foreign and Alaskan), predicting 3.1 large oil spills occurring and contacting the Channel Islands, within 30 days. The probability that at least 1 spill will occur and contact the Channel Island Marine National Marine Sanctuary is 0.96.

Most Likely - Conclusions. The number of large spills ($\geq$1,000 bbls) predicted to occur as a result of the Proposed Lease Sale No. 73 during the anticipated production life of any fields discovered as a result of this Sale is 1 (0.90), and of very large spills ($\geq$10,000 bbls) is less than 1 (0.40) (Table IV.A.4-2). One spill is expected to occur and contact the northern portion of the Channel Islands National Marine Sanctuary.

Although, most areas are not expected to be contacted by a spill resulting from Proposed Lease Sale No. 73 activities, a spill is always theoretically possible wherever offshore oil activity is present.

The oil spill model predictions for Proposed Sale No. 73 for the individual land segments show only two segments with any expected number of spills (0.1 spills each) occurring and contacting them (land segment numbers - 25 in the Port San Luis area, and 39 - the northern side of San Miguel Island) within 30 days of the time of the spill. The probabilities of one or more spills occurring and contacting land segments ranged from 0 to 14 percent, those same segments showing the highest risks of 7 and 14 percent, respectively. The model predictions for risk to targets ranged from 0.4 expected spills occurring and contacting target "land", with a 34 percent probability of one or more spills, to 0 spills and 0 (less than 0.05) percent probability for the Farallon Islands and Begg Rock. The total sea otter range was predicted to have 0.1 spills occurring and contacting it, with a 13 percent probability of one or more spills, within 30 days, as a result of Proposed Sale No. 73. Most of this risk is in the southern half of the range, where 0.1 spills are predicted, and an 11 percent probability of one or more spills occurring and contacting the southern part of the range exists. The Channel Islands Marine Sanctuary was predicted to have 0.3 spills over the life of the Proposed Sale No. 73, with a 26 percent chance of one or more spills occurring and contacting it within 30 days. All of this risk is for the northern four islands of the Sanctuary. As explained earlier, the attitude was taken that a 25 percent or greater probability was the cut-off for when one or more spills was actually "expected" to take place, when evaluating the expected impacts to the particular resource.

In summary, no spills are expected to occur and contact any individual land segments or targets (except target "land" and the Channel Islands Marine Sanctuary) from Proposed Sale No. 73. Overall, one large spill (0.90) is expected to occur over the anticipated production life of fields discovered as a result of Proposed Sale No. 73.

Condition Mean - Conclusions. The number of large spills ($\geq$ 1000 bbls) predicted to occur as a result of the Conditional Mean is 3, and for very large spills ($\geq$ 10,000 bbls) is 1. The model results for the individual land segments show only three segments with a greater than 10 percent probability of one or more spills occurring and contacting. These segments are numbers 25, 39, and 41, representing the Port San Luis area, the northern side of San Miguel Island, and Santa Rosa Island. The number of expected spills occurring and contacting these segments are 0.2, 0.5, and 0.1 spills, within 30 days and the probabilities of one or more spills are 14 percent, 40 percent, and 13 percent,respectively. The model predictions for risk to targets ranged from 1.3 spills with a 73 percent of one or more spills occurring and contacting target "land" within 30 days, to 0 spills with 0 percent probability for the Farallon Islands.

The total sea otter range was predicted to have 0.3 spills occurring and contacting it, with a 24 percent probability of one or more spills occurring and contact it within 30 days. The Channel Islands Marine Sanctuary was predicted to have 1.1 spills occurring and contacting with a 66 percent probability of one or more spills occurring and contacting within 30 days.

Cumulative. The number of large spills ($\geq$1,000 bbls) predicted to occur during the production life of the oil fields found as a result of Proposed Sale No. 73, due to existing Federal leases in all of California is 3.41, and from crude oil import tanker transportation in the study area (includes all

of California and Oregon) is 4.96. The number of very large spills (≥10,000 bbls) predicted to occur from existing Federal leases in all of California is 1.46 and from crude oil import tanker transportation 2.52. The Proposed Sale No. 73 therefore represents an additional risk of 10 percent for a very large spill in California. This indicates that Proposed Sale No. 73 adds a relatively small additional risk of an oil spill to that already existing due to activities on currently active leases and import tankering of crude oil.

As discussed earlier, small spills (<1,000 bbls) occur most often, and can be expected to occur as a result of Proposed Sale No. 73. These spills, however, are lost most quickly to the environment, and are most responsive to clean-up efforts.

b. Effects on Marine Life: The literature on the effects of oil on marine life continues to grow and the emphasis in research continues to shift away from static acute (96 hour) toxicity bioassays. The overview of hydrocarbon effects on marine organisms presented in the FEIS for OCS Lease Sale No. 68 (Section IV.A.1.c) (BLM, 1981) should be referred to by the reader and this section expands upon that literature.

Petroleum hydrocarbons may have short-term acute and long-term chronic effects on marine organisms. The short-term, acute effects are those usually associated with accidental oil spills while the long-term chronic effects, which are less investigated, are usually associated with the natural phenomenon of oil seeps, the slow dissolution of sediment trapped oil spill residues after a spill or large volume municipal-industrial effluent discharges. Acute effects are generally measured in the laboratory by 96-hour (or shorter) bioassays wherein an organism is exposed to the toxic substance for 96 hours. Results of these bioassays must be interpreted with some caution when attempting to predict the effects on marine organisms outside the laboratory environment. Many factors affect behavior of oil spilled in the ocean. These combine with biological factors such as age, reproductive maturity and physiological stress from nonpetroleum pollutants and affect individual organisms' response to petroleum in the natural environment. The problems associated with maintaining organisms in long-term laboratory bioassays and monitoring a wide spectrum of possible effects other than death have kept the amount of information from which to predict long-term natural effects sparse. These long-term sublethal effects of chronic exposure to low levels of petroleum hydrocarbons are less dramatic than the death response to short-term, high doses. However, in relation to maintaining populations of marine organisms, sublethal effects such as reduced reproduction may prove to be much more important.

The uptake and effects of crude oil and components of crude oil have been extensively investigated during the last decade. The reader is referred to Anderson (1975), Malins (1977), Wolfe (1977), Neff (1979) and Neff and Anderson (1981) for good in-depth reviews of much of the research. In addition studies are in progress funded by the Minerals Management Service (MMS), National Marine Fisheries Service, and Environmental Protection Agency.

Effects on Microfauna and Microflora. (Bacteria, Phytoplankton, Zooplankton). The role of bacteria in reducing the amount of spilled oil may be significant. Colwell and Walker (1977) have demonstrated that up to 90 percent of nonvolatile components of crude oil may be biodegraded by microbial action. Recent

consideration of the role of microbes in oceanic food chains (Morita, 1977; Pomeroy, 1980) and consequences of hydrocarbon effects on either microbial photosynthesis, metabolism, or species composition indicate the need to consider the response of microbes to spilled oil. In this regard, it is important to note the work of Atlas (1975) and Atlas and Bartha (1972) who noted that volatile components of some crude oils can delay or prevent biodegradation. Also, the response of marine microbial populations to spilled oil may depend in part on any previous exposure to oil. Walker and Colwell (1976) found that bacterial counts decreased in areas not previously exposed to oil whereas the counts increased in areas of chronic oil exposure. Atlas (1981) points out, however, that generally less than 0.1 percent of the microbial population in unpolluted habitats are hydrocarbon degrading while up to 100 percent of the microbial population may be capable of degrading hydrocarbon in oil-polluted ecosystems. In addition, there may be a succession of bacterial species in the microbial ecosystem (Horowitz, et al., 1975) due to differential abilities and/or ease in degrading the various classes of hydrocarbons found in crude oil (Atlas, 1981).

The effect of hydrocarbons on phytoplankton and zooplankton populations has been investigated in both laboratory and field studies in recent years. Results indicated enhanced growth of phytoplankton (see FEIS Sale No. 68 Section IV.A.1) when exposed to low concentrations of petroleum. However, in these experiments bacteria may have accounted for oxidation of hydrocarbons, increased CO_2, and subsequent stimulation of phytoplankton growth. Thus, there remains some question as to the actual amount of stimulation of phytoplankton caused by petroleum hydrocarbons. Recently, microalgae have been shown to degrade aromatic compounds (Cerniglia, et al., 1980) and further work may show phytoplankton to be a significant component of removing crude oil from the environment.

Numerous studies have been done on zooplankton of many phyla. Much of the work has been concerned with establishing acute toxicity levels. Comparison of the resulting data amoung phyla with an eye to generalizing lethal levels of hydrocarbons is difficult because most studies only specified initial concentrations of total oil and lack detail of oil composition or concentration-time relationships. Corner (1979) recently reviewed much of the available literature and details of studies to 1978 may be referenced there. Rinkevich and Loya (1977, 1979) have shown inhibition of settlement of planula larvae of the coral Stylophora pistillata when exposed to Iranian crude oil (concentration not specified). Planktonic larvae of Mercenia, a clam, were inhibited in growth when exposed to refined and crude oils between 0.22 and 4.2 mg/l (Byrne and Calder, 1977) while Winters, et al., (1977) demonstrated increased growth rate in mussel larvae at 10 ppm water soluble fraction of single hydrocarbons.

The great majority of work with zooplankton has been done with crustacean larval and adults. The toxicity data indicate short-term (4 day) LC_{50} range of low (2-10) ppm to moderate (100) ppm concentrations of crude oils or crude oil components to copepods, amphipods, and decapods (Ott, et al., 1978; Wells and Sprague, 1976; Hollister, et al., 1980). Lower growth rates have been observed in Acartia hudsomica exposed to Venezuelan crude (Hebert and Poulet, 1980) and short exposure of Eurytemora affinis and Nitocra affinis to water soluble fraction (WSF) of fuel oil (10 min. to 3 hr. at 3 ppm) resulted in reduced numbers of eggs per female, smaller brood size, and

shorter life span (Berdugo, et al., 1977). Shrimp appear especially sensitive to hydrocarbons.

Sanborn and Malins (1977) found Stage IV larvae of Pandalus platyceros were killed by 8-12 ppb naphthalene in 1-1.5 days. Crab larvae have been extensively investigated in recent years and appear to be as sensitive as shrimp larvae (Sanborn and Malins, 1977). Development and growth in Cancer irroratus larvae were delayed upon exposure to No. 2 fuel oil at 0.05 to 0.19 ppm (John and Pechenik, 1980).

Two studies of hydrocarbon effects in echinoderm larvae have shown reproductive and growth effects. Respiration of sand dollar sperm was sensitive to WSF of No. 2 fuel oil (Nicol, et al., 1977) and embryos developed abnormally at con-
The teleost component of the neuston (fish component of zooplankton) is of obvious concern in considering effects of crude oil on marine ecosystems. A rather small number of species have been the focus of research attention (herring, Clupea; code, Gadus; flounders and killifish; striped bass; morine; and freshwater salmonids). Concentrations of hydrocarbons eliciting both lethal and a variety of sublethal responses have been generally less than 10 ppm for eggs and larvae (Linden, 1978; Kuhnhold, et al., 1978; Linden, et al., 1980; Struhsaker, 1977; Vuorinen and Axell, 1980; Smith and Cameron, 1979).

Experiments funded by the Minerals Management Service Pacific OCS Region exposed eggs and larvae of the northern anchovy, Engraulis mordox, to WSF of Santa Barbara crude oil for 14 days. Statistically significant reductions in growth among control and experimental larvae were observed at 7 days (and subsequently at 14 days) at concentrations as low as 5 ppb added hydrocarbon. Hatching success was also significantly reduced at 50 and 500 ppb WSF but not at 5 ppb. The major developmental abnormality observed in the larvae was a malformed upper jaw with associated reductions in cranial bone formation and pectoral fin development. These results have obvious implications regarding the survival of larval and juvenile fish due to interference in efficient/successful feeding.

Several controlled ecosystem experiments and observations of phytoplankton and zooplankton in real oil spill investigations have occurred in the recent past. These have led to a better understanding of the consequences of crude oil in these portions of the ecosystems although it cannot be claimed that our knowledge is complete at this time. The CEPEX (Controlled Ecosystem Pollution Experiments) and MERL (Marine Ecosystems Research Laboratory) systems were designed and run to simulate spill and chronic oil pollution events. The CEPEX studies involved No. 2 fuel oil, naphthalenes, and Prudhoe Bay crude oil. The most direct effect of oil on zooplankton communities occurred during the second year when microflagellates became dominant in the experimental containers but not in the control chambers (Lee, et al., 1978). The MERL experiments demonstrated changes in respiration and excretion rates in the copepod Acartia clausi and A. tonsa and depression of total zooplankton abundance (Vargo, 1981).

Two extensive studies of zooplankton response to spilled oil were ARGO MERCHANT (1976) and AMOCO CADIZ spills. Oil was found adhering to the cuticle and appendages of plankton and oil particles were found in the guts and fecal pellets of copepod plankton (Mackie, et al., 1978; Maurer, 1976). Plankton diversity was reduced along the French coast from the AMOCO CADIZ spill (Spooner,

1978) while dead fish eggs and malformed fish embryos were observed in the ARGO MERCHANT spill off Massachusetts (Longwell, 1978).

The general conclusions from these two spills and others studies over the last decade is that the response of zooplankton is short-term where detected and that there are seldom any significant prolonged changes in either biomass or standing stocks of individual zooplanktons in open water near spills.

Effects on Macrofauna. The focus of the attention of research on the effects of crude oil or crude oil components on marine macrofauna has turned in recent years away from concentration on short-term acute bioassays and gross overall individual organism effects. Focus instead is towards understanding effects in ecosystems and the specific routes into and out of organisms. This turn towards trying to understand more basic mechanisms has also focused research on the habitats most likely to have any measurable effects, the sediments. The investigations of Addy, et al., (1978) in the North Sea have shown changes in benthic fauna strongly correlated with levels of hydrocarbons in the sediments. Benthic fauna in the MERL experiments exposed to 109 ppm oil in the upper 2 cm of sediments decreased drastically in numbers. Smaller infauna such as harpacticord copepods, osteacods, and numatodes also decreased (Grassle, et al., 1981). Sublethal effects of oiled sediments have been demonstrated. Roesijadi and Anderson (1979) found that *Macoma inquinata* exhibited reduced condition index and levels of free amino acids when exposed to sediments with 1,200 ppm oil. Similar experiments with the polychacte *Abarenicola pacifica* have shown reduced feeding and glycogen level at 500 and 1,000 ppm oil in sediments (Augenfeld, et al., 1982). Vanderhorst, et al., (1981) has carried out a 3-year study of experimentally oiled sediment trays in the Strait of Juan de Fuca. He found significant biological effects in recovery rates for the clam *Protothaca staminea* due to oil. Recovery also depended on substrate type with full recovery of a commercial clam bed oil with 2,500 ppm at 46 months (both predicted).

Fish. Effects of spilled hydrocarbons on fish populations are difficult if not impossible to demonstrate in the ocean. A number of laboratory investigations have examined effects of oil on the more sensitive egg and larval stages of several species of fish (see discussion above). However, as Teal points out, if an oil spill were to severely damage an otherwise successful year class, it would simply fail to appear in the fishing and no one would know or even be able to make a good guess as to whether there was a connection between the spill and failure of the year class or whether this was simply another poor recruitment year (Teal, 1981, personal communication).

The toxicity of oils to fish were discussed in the FEIS for OCS Lease Sale No. 68. The study funded by the MMS for the last 2 years has shown lethal toxicity values of between 50 and 500 ppb of WSF Santa Barbara crude oil to the California halibut and northern anchovy in exposures lasting 120 days. Fish are able to metabolize aromatic hydrocarbons (the most toxic fraction); however, studies by Malins and Varanasi (Malins and Varanasi, 1977; Varanasi, et al., 1981; Varanasi, 1978) have shown that metabolites of aromatic hydrocarbons may be more toxic to cellular DNA than the parent hydrocarbons and may persist for much longer in fish than the parent hydrocarbons. The main site of metabolism in fish (and vertebrates in general) is the liver with subsequent secretion of aromatic hydrocarbons and their metabolities (mainly phenols, quinones, dihydrodiols, and other oxygenated derivatives of the parent aromatic) into the bile. Other pathways of excretion are the skin and gill

membranes (Varanasi, et al., 1978; Thomas and Rice, 1981).

Mammals. The amount of research on the effects of oil on marine mammals remains sparse. Absorption of hydrocarbons by seals immersed in oiled water has been demonstrated (Englehardt, et al., 1977; Geraci and St. Aubin, 1981). As in fish, the study results to date show the liver to be the main site of hydrocarbon metabolism and metabolites may be more toxic than the parent compounds. The effects of external coating of marine mammals has been investigated by Warner (1969), Smith and Geraci (1975), La Boeuf (1971), and Geraci and Smith (1976). The results of these experimental oiling and observations has shown little correlation with death in cetaceans. Recent results of the MMS funded research into the ability of marine mammals to detect oil (Geraci, unpublished) has indicated that seals are able to detect surface slicks of oil. This may or may not have importance in allowing mammals to avoid oil spills.

The effect of external coating of oil on thermo-regulatory abilities in marine mammals has been studies by Kooyman, et al., (1977), Costa and Kooyman (1980), and Oritsland, et al., (1981).

The object of these studies have been sea otters and polar bears, those mammals in which the pelt rather than blubber plays the dominant thermo-regulatory role. The results show that thermal conductance from the body surface increased significantly. The metabolic rates of the polar bears increased significantly from basal levels as did the sea otters.

Birds. The obvious effects of external oiling of sea birds was discussed in the FEIS for OCS Lease Sale No. 68 and the result of oiling of birds is to some degree dependent on the amount and type of oil and the response of the bird (Birkhead, et al., 1973).

Results of laboratory studies of sublethal effects of ingested oil have shown a variety of physiological and reproductive effects. Miller, et al., (1978a,b) claimed reduced growth rate in young herring gulls and black guillemot while Gorman and Sims (1978) failed to find growth retardation in herring gulls. Grace, et al., (1977) showed reduction in egg production in the Japanese quail with exposure to No. 2 fuel oil. Small amounts of oil applied to eggs have been shown to kill the developing embryo inside (Albers, 1978; Coon, et al., 1979; White, et al., 1979).

Extrapolation from laboratory studies of sublethal or lethal effects on birds to effects of crude oil spills on seabird populations is extremely difficult and any conclusions tenuous at best. Variations in reproductive success are influenced by weather, food supply, predation, etc. and these can easily mask variations induced by hydrocarbons. Furthermore, population dynamics of species of concern may differ from the species tested in the laboratory.

5. Manmade Structures: Manmade structures are discussed in detail in the Final Environmental Impact Statements for OCS Lease Sale Nos. 48, 53 and 68 (BLM, 1979, 1980 and 1981, respectively), in the Oil and Gas Transportation Scenarios for Proposed Sale No. 73 (Yamasaki, 1983), and below:

a. Onshore Manmade Structures: For the proposed sale, onshore manmade structures refer to shore and land facilities or structures that would be needed to support the proposed hydrocarbon activities. There would be a need for the following types of onshore structures or facilities, according to Transportation Scenario No.1 (Yamasaki, 1983) (Also see Section IV.E.3.n):

(1) Oil and gas treating facilities;
(2) Crude oil storage tanks;
(3) Supply and crew boat bases;
(4) Onshore hydrocarbon pipelines;
(5) Temporary support bases for onshore and offshore pipeline
(6) Airports (existing) for helicopter support activities.

Direct, impact-producing agents resulting from these onshore manmade structures include space-use conflicts, air emissions, and temporary beach disturbance. Refer to Section IV.E for specific discussions on impacts to a resource.

b. Offshore Manmade Structures: Significant impact-producing agents related to manmade structures include the following:

(1) Oil and gas exploratory, installation, and/or construction activities (all short-term presence).
(2) Presence of offshore structures: Platforms, pipelines, SALMs and Marine Terminals (all long-term presence).

Exploratory Activity-Short-Term Presence

Exploratory operations usually involve the use of a ship-shaped drilling rig, support vessels (crew, supply, or tug boats), and helicopters. These operations are typically short-term, lasting approximately four months per well, per site.

Generally, three types of drilling rigs are used for exploratory operations: semi-submersible rigs, drillships, and jack-up rigs. The Diamond M General is typical of the semi-submersible drilling units used in the Pacific OCS region. This unit is a self-propelled 290-foot (90 m) drilling rig. The primary equipment on the rig includes eight 30,000 lb. (13,600 kg) anchors, two 50-ton cranes, and a 160-ft. (49 m) derrick. Propulsion for the vessel is furnished by twin propellers, each driven by six 850 hp electric motors.

The Glomar Pacific is typical of the drillships used in the Pacific OCS region. The Pacific is a self-propelled 452-foot (140 m) drillship. The vessel is moored with an eight point wire line system using eight 30,000 lb (13,600 kg) anchors, or it can be dynamically positioned with thrusters. Each anchor is marked by a welded steel cylindrical anchor buoy, 10.5 ft. length x 8 ft. diameter. A 142 ft. derrick is situated in the center of the vessel with two nearby working cranes.

The Rio Colorado I is a typical jack-up rig. The rig is 200 ft. long and it is towed onto the drilling site by tug boats. The legs are jacked down to the ocean bottom. The rig remains floating until the legs attain proper placement on the bottom and the rig deck is elevated about 30 ft. above the water level. The primary power on board the rig is furnished by five diesel generator sets.

Direct, impact-producing agents of exploratory operations are as follows:

(1) Vessel anchorage;
(2) Drilling process;
(3) Vessel presence; and
(4) Discharges.

These impact agents are discussed below. Refer to Section IV.E for specific discussions on impacts to a resource.

Vessel anchorage would impact the organisms inhabiting the ocean bottom, particularly in rocky and mud-clay bottom areas. As anchors are lowered onto the substrate, epifauna, epiflora, and infauna would be crushed, either by the anchor itself or by the anchor chains. When the anchors are removed, they are sometimes dragged toward the drillship, crushing organisms along the way. However, the standard method of retrieval is for work or tug boats to pick up the anchors and carry them back to the drill vessel. Anchors have also caused mud mounds, trenches, or scars. Anchors could also impact cultural resources such as historic shipwrecks or aboriginal sites.

The drilling process itself is a direct, impact-producing agent. A typical well is begun with the drilling or jetting with seawater of a surface hold (usually 30-36 in diameter) to a depth of 100-350 ft. The materials (drill cuttings) that result from this first several hundred feet are directly discharged to the ocean bottom. Subsequent cuttings are returned to the drill vessel and discharged from there. Surface casing is then cemented to the bottom surface. Progressive sections of the hole are drilled with progressively smaller drill bits. Thus, the actual volume of cuttings that are discharged steadily decreases with increasing well depth. Other discharges to the water column and bottom include drill muds and formation water. Discharges to the water column and bottom are discussed in detail in Section IV.A.8.a of this document. Discharges to the air result from the mechanical operation (diesel engines) of the drilling process. These discharges include SO_x, NO_x, and particulates. Discharges to the air are discussed in detail in Section IV.A.5.b of this document.

Another direct, impact-producing agent of exploratory operations is the presence of the drill rig itself. Vessel presence may result in any of the following effects:

(1) Navigational hazards;
(2) Spatial preclusion of fishing activity; and
(3) Viewshed disruption

It should be pointed out here that the potential for this impact-producing agent to occur is only temporary in nature (generally duration is less than 4 months), since we are only considering exploratory operations at this point.

Vessel presence could result in navigational hazards to other vessels under

certain adverse conditions. These adverse conditions include periods of high sea state and periods of reduced visibility (e.g., during fog, rain, etc.). Exploratory operators must comply with applicable MMS operating orders and all USCG safety, navigation, and notification requirements.

Fishing space will be temporarily displaced at any site occupied by a drilling rig. Generally, the spatial reduction of fishing is dependent upon the water depth of the wells and is about twice the area taken by the drilling rig or is within the boundary of the anchor scope radius. Thus, one typical rig, drilling in water could preclude fishing from an area of up to 1.2 km^2.

Vessel presence could result in temporary viewshed degradation.

Development Activity - Platform, and Subsea Pipeline
Installation Operations - Short-term Presence

Platforms. Platform installation operations usually involve the use of barges, crew boats, supply boats, tug boats, helicopters, and the platform itself. These operations are typically short-term, lasting less than 6 months per platform. Platforms are generally fabricated at onshore platform fabrication yards and transported to the offshore site by barge for erection. Platform jackets are launched from a launch barge and lowered to the ocean bottom by controlled flooding. Steel pilings are driven to the desired depth through the jacket legs. The platform is leveled, grouted, and welded in place to each of the piles. Platform raising generally requires a few weeks and the total site installation time is approximately 6 months.

Direct, impact-producing agents that are associated with platform installation operations are:

(1) Vessel anchorage; and
(2) Vessel presence.

These impact-producing agents are similar to those associated with exploratory operations. Refer to Section IV.E for specific discussions on impacts to a resource.

Subsea Pipeline Installation-Short-term Activity

Installation activities usually involve the use of an installation barge and support vessels (crew, supply, or tug boats). These operations are short-term and usually last less than ten days. (This would vary, depending on the length of pipeline to be installed and weather conditions.)

A number of different methods are presently available to install offshore pipelines. Pipelines are initially prepared for installation either at an offshore pipeline lay-site on a pipeline lay barge, or at an onshore facility, then towed to the lay-site by a reel barge, surface tow or bottom tow method.

Direct, impact-producing agents that are associated with subsea pipeline installation operations are:

(1) Vessel anchorage;

(2) Vessel presence;
(3) Pipeline burial operations;
(4) Explosion of rocky areas; and
(5) Abandoned buoys.

These impact agents are discussed below. Refer to Section IV.E for specific discussions on impacts to a resource.

The potential impacts from vessel anchorage and vessel presence are similar to those associated with exploratory operations. A major difference is as follows: Exploratory operations take place at a stationary location (i.e., the well-site). The installation activities of subsea pipelines take place over a much greater distance (i.e., the pipeline route). Thus, the potential impacts from vessel anchorage (i.e., anchor scars) or vessel presence would be distributed over a much greater area.

Long-Term Presence of Offshore Structures - Platforms, Pipelines, SALMs, Subsea Wellheads

The previous section concentrated on short-term activities: exploratory, installation, and/or construction operations. This section will deal with the long-term hydrocarbon activities (i.e., lasting for periods of 20 to 40 years). These long-term activities are the actual presence of structures and their associated discharges and emissions. Chronic discharges are treated in Section IV.A.8; air emissions in IV.A.8.c. Impacts to the offshore structures could result in an oil spill. Once installed, offshore platforms become a quasi-permanent feature of the OCS area. This long-term presence can potentially lead to various hazards and aids as presented and discussed below. Refer to Section IV.E for specific discussions on impacts to a resource.

(1) Navigational hazards;
(2) Viewshed disruption;
(3) Spatial disruption (e.g., pre-emption of fishing space);
(4) Navigation aids; and
(5) Artificial habitat for marine organisms (fishes, invertebrates, and seaweeds).

Platform presence could result in navigational hazards to other vessels under certain adverse weather conditions. These adverse conditions include periods of high sea state and periods of reduced visibility (e.g., during fog, rain, etc.).

Platform presence also produces a long-term degradation of the viewshed.

Fishing space will be displaced at any site occupied by a platform. Platforms occupy about 3 ha (8 acres) of space. This space would not be available for fishing.

Platforms could serve as an aid to navigation due to their long-term presence. Usually the platforms appear on Coast Guard charts and serve as a good reference point for ship captains, barge operators, or boating enthusiasts.

The long-term presence of a platform in the water column serves as an excellent artificial habitat for marine organisms. Invertebrates and macrophytes (sea-

weeds) will settle onto this new substrate, rapidly following the platform's installation. These organisms develop quickly and serve as an attractive food source for offshore fish populations. A more in-depth discussion of artificial habitats is given in Section III.C.5 of this document.

The long-term presence of a subsea pipeline on the ocean bottom could cause conflicts with commercial fishing operations.

SALMs occupy only a small space on the ocean bottom and surface. However, with a tanker tied to a SALM mooring line, the vessel could swing or rotate in a circular direction around the mooring site. The maximal swing distance for the SALM located at Platform Hondo in the western end of the Santa Barbara Channel, is estimated at about 600 m (1,829 ft).

6. Vessel Traffic

a. Oil Tankers: These vessels range in size from the general purpose tankers (up to 25,000 to 150,000 DWT), to the Ultra Large Crude Carriers (300,000 to over 500,000 DWT). Dead Weight Tons are defined as the total weight of a tanker when it is immersed to the authorized load depth. According to Transportation Scenario No. 1 (Yamasaki, 1983) two sizes of tankers would be used to transport Proposed Sale No. 73 crude: 27,000 and 45,000 DWT. A 27,000 DWT tanker has a storage capacity of about 200,000 bbls of oil, while a 45,000 DWT tanker can hold about 335,000 bbls of oil. (storage capacity depends on the density of the tranported oil). A typical 16,500 DWT tanker is 532 ft in length, with a draft (depth a vessel is immersed in water when afloat) of 31 ft and a beam (extreme width of the vessel) of 70 ft. A typical 100,000 DWT tanker is 861 ft long, with a draft of 50 ft and a beam of 125 ft.

Direct, impact-producing agents that are associated with tankers include additional vessel traffic, accidents, tanker operations, and oil spills (either from normal operations or catastrophic events). The principal causes of most vessel accidents are (Marks, 1982) groundings, collisions, and breakdowns.

The smaller sized tankers (6-35 M DWT) and the medium-sized tankers (35-160 M DWT) exhibit the highest casualties per 100 tankers at risk on a worldwide basis. Tanker accidents can lead to massive oil spills. Oil spills from tankers may also occur during tankering operations. According to the National Academy of Sciences (1975), most of the one million tons of oil per year that does go into the ocean from tank cleaning operations is due to ships not using certain procedures.

b. Supply and Crew Boats: Supply and crew boats are used to service offshore hydrocarbon activities. Supply boats are typically used to transport drilling equipment, cement, drill muds, oil contaminated mud, cuttings or formation water, food, and other supplies to and from the platform, or drillsite. Supply boats require harbor or port facilities such as docks, berthing space, and staging areas (for the storage and loading of equipment and supplies). Crew boats are most typically employed to transport drilling personnel to and from the platform or drill-site. Unlike supply boat requirements, crew boats only require docking and berthing facilities at harbors or ports. During periods of adverse sea conditions, helicopters are used to transport drilling personnel.

Direct impact-producing agents that are associated with supply and crew boats follow. These are explained below.

(1) additional marine traffic
(2) support facility requirements
(3) crew and supply boat engines (air emissions)

Impacts associated with additional marine traffic are the increased possibility of vessel-vessel and vessel-structure incidents. These incidents could lead to oil spills, loss of lives, and loss of equipment.

Impacts that are associated with support facility requirements include space-use conflicts between the oil industry and other industries (e.g., commercial fishing, lumber, etc.).

Impacts that are associated with crew and supply boat engines are air emissions (fumes, exhaust, etc.) which could potentially degrade the ambient air quality.

c. Seismic Survey Operations: Seismic operations are used to determine the presence of hydrocarbons under the ocean bottom. Seismic operations work on the principles of sound reflection and refraction. Reflection involves sound that is reflected, or echoed, from a rock layer. Refraction uses sound that travels along a rock layer for some distance and returns to the surface. Reflection is the most commonly used method today. Reflection exploration is conducted by artifically producing a sound at or near the ocean bottom, and then recording the echoes from the subsurface structures. Generally, a seismic boat (or geophysical) boat is used to carry out the exploratory activities. The boat is usually about 150 to 200 or more feet long.

The seismic source used most often in offshore operations is the air gun. It consists of a chamber that is filled with compressed air, which is suddenly released. The pop of the released air is the seismic impulse. From four to twelve air guns are towed behind the boat at a depth of about 30 feet, with hoses extending from them to air compressors on deck. Air is pumped into the guns, the air is released, resulting in a "pop." The pops occur at about 10 second intervals, for the length of a line. Lines are up to 2-3 miles long. Another method of seismic surveying is to use a marine gas gun. Gas guns fire a mixture a propane and oxygen, or oxygen-enriched air. An array of gas guns are trailed behind or alongside the boat, in a similar way that air guns are towed.

Several other seismic energy sources are used in offshore surveying operations. These sources include steam and explosive charges. Explosive charges are no longer used in seismic survey operations.

Direct, impact-producing agents that are associated with seismic operations follow. These are explained below.

(1) Subsurface impulses
(2) Presence of vessel and associated trailing gear

Impacts from subsurface impulses include physical disturbance of the water column or ocean bottom, and noise production. Pops from air guns could disturb nearby fish or plankton populations. Noise production from the seismic dis-

charges could affect nearby marine mammal populations: either by disturbing their migratory path or actual physical disturbance of the animals.

Possible impacts from vessel presence and trailing gear (up to 2-3 miles long) presence include spatial preclusion of commercial or recreational fishing, disruption of crab or lobster pots and navigational hazards.

7. Noise and Other Disturbances: Noise emissions resulting from OCS development are associated with the operation of offshore platforms, drilling rigs, seismic geophysical surveying, petroleum transfer facilities, onshore processing plants, pump stations, helicopters, and boats. In addition, construction equipment used during the installation of the various facilities emit various amounts of noise. The degree of noise impact depends upon the emitted sound level and the proximity of the source to schools, hospitals, residences, and recreation areas. The precise location of the various facilities is not known at this time. Thus, site-specific noise impacts cannot be evaluated here; however, they will be considered in a future EIS when development plans are known.

Machinery noise sources found on drilling and production platforms are, generally, similar to those used for shore-based operations. Special noise attenuation devices are sometimes used offshore to protect workers in their living quarters located on the platforms. Compressors and diesel engines are usually the loudest equipment on a typical platform emitting about 90 dBA* at a distance of 15 m (50 ft). By comparison, a diesel truck under full load also emits about 90 dBA at 15 m. Although other sounds, such as banging of pipes and use of explosives may be more intense, they are of extremely short duration. The possible impact of Proposed Sale No. 73-related noise emissions on the biological environment is discussed in subsequent sections.

In a quiet sea with light wind conditions, normal offshore platform operations would be inaudible beyond about 2 miles (assuming ambient background noise level of 40 dBA and attenuation due to sound wave spreading only). In rough seas and weather conditions, the offshore facility would be inaudible beyond about 1/8 of a mile (assuming 70 dBA background). No onshore noise impact from normal operation of OCS platforms are expected since even under low background noise conditions they would not be audible from shore. Onshore noise levels could be slightly increased by Proposed Sale No. 73-related vessel, vehicle and helicopter traffic; however, these increases are generally expected to be small. Gales (1981) points out that in light seas the sub-sea surface noise propagated by a platform could be detected up to 100 miles away.

Most of the onshore processing and support facilities would necessarily be located in industrially zoned areas where noise would have a minimal impact. If adverse noise impacts could result, mitigation measures such as sound barriers (i.e., earthen berms, block walls, etc.) and mufflers could be utilized. The site-specific noise impact of these developments will be considered in a future environmental document when detailed development plans are known.

8. Effluents and Discharges

a. Water: The development and operation of offshore oil and gas producing facilities will cause the discharge of materials that may have

TABLE IV.A.8.a-1

PREDICTED VOLUMES OF EFFLUENTS AND DISCHARGES FROM PROPOSED SALE NO. 73

No. Platforms	Drill Cuttings (BBLs)	Cu. Yds. Sediment Pipeline Burial	Muds to be Dumped (BBLs)	Formation Water (MBBLs)	Sewage Gal/Day
5	249,216	499,379	449,051	112,464	19,000

an impact on the natural environment. Material that is discharged would result from two types of activities: 1) normal or routine activities and 2) episodic or occasional emission events (e.g., oil spill) resulting from equipment failure, poor operation techniques, or a variety of events. Drill cuttings, drilling muds, formation waters, and sewage are the types of materials expected to be discharged. The discharge of effluents from OCS activities are under the jurisdiction of the EPA through the National Pollution Discharge Elimination System permits.

Drill Cuttings and Muds. Once drilling starts, drill cuttings and muds may be discharged by dumping into the ocean or they may be barged to onshore disposal sites. Daily discharges of cuttings vary but may range from 0 to 1,700 barrels per day for a single exploratory rig.

The total amount of cuttings and drilling muds estimated to result from this sale is given in Table IV.A.8.a-1. These figures are liberal in that drilling muds are frequently used to drill several wells from the same platform. In the case of costly muds, the material may be transported to other platforms for use in drilling production wells (Dames and Moore, 1980, comments on DEIS for Sale No. 53).

Drill cuttings are composed of rock fragments and liquids contained in the geological formation through which the drilling bit is traveling. To remove the drill cuttings, drilling mud (fluid) from the mud system (mud tanks) is circulated down the hole (well) through the drill pipe. Drilling mud is passed out through the drilling bit nozzle, picking up drill cuttings, and returns to the surface between the drill pipe and walls of the bore hold and/or casing. At the surface, drill cuttings are physically separated from the mud by screening and washing techniques. After the drill cuttings and drilling mud are separated, the drill cuttings are discharged to the ocean and the mud is returned to the mud tank for recirculation down the hold. Drilling mud that adheres to the drill cuttings is discharged to the ocean. Additionally, mud is discharged to the ocean when excess mud is generated by:

(1) Adding solids or water to adjust the mud properties
(2) Changing mud types
(3) Dumping at the conclusion of drilling unless mud can be used in a subsequent well (Sheen Technical Subcommittee, 1976)

Removal of drilled cuttings from the hole is only one function of drilling mud. To obtain satisfactory results in the completion of any well, drilling muds have a variety of functions: controlling subsurface pressures, cooling and lubricating the bit and drill pipe, preventing the walls from caving, preventing clogging of the formation penetrated.

The diversity of drilling hole characteristics coupled with the variety of purposes for which drilling mud is employed ensures that there is no "typical" mud. The ranges in weights of materials composing drilling mud are given in Table IV.A.8.a-2 for muds tested under the EPA guidelines. The concentration of trace metals in whole muds (not used or diluted) are given in Table IV.A.8.a-3 for the EPA muds. Although the mud programs for the central and northern California offshore area may be similar to those mud programs currently used

*dBA is defined as the A-weighted decibel level. It is a weight average of sound levels

TABLE IV.A.8.a-2

COMPOSITION OF TESTED GENERIC MUDS

Component	Range (pounds per barrel)
-Barite	0 to 450 (700)
Attapulgite or Bentonite Clay	10 to 50
-Lignosulfonate (Chrome and Ferrochrome)	2 to 15 (20)
Lignite	1 to 10
Drill Solids (Walnut shells, leather)	20 to 100
Sodium Hydroxice	
Soda Ash/Sodium Bicarbonate	0 to 2
Cellulose Polymer	0 to 5
Lime (CaOH)	0 to 20
Sodium Chloride	--- (10 to 125)

TABLE IV.A.8.a-3

METALS COMPOSITION ON DRILLING MUDS
TESTED BY EPA PROGRAM

Metal	Concentration (ppm-whole mud)
Arsenic	1 to 3
-Barium	2,800 to 141,000 (303,700)
Cadmium	1 (54.4)
-Chromium	2 to 265 (1,159)*1
Copper	2 to 26 (280)
Lead	1 to 24 (915)
Mercury	1 (0.015 to 0.07)*2
Nickel	1 to 8 (33)
Vanadium	6 to 35
Zinc	12 to 181 (12,270)

*1A Mobile Bay mud had 5,960 ppm Cr

*2An arctic mud had 2.8 ppm Hg

in Southern California; the specific mud programs for central and northern California cannot be listed until drilling is initiated in that area.

Discharges of drilling mud must comply with requirements found under OCS Order No. 7 and the National Pollutant Discharge Elimination System (NPDES) permitting procedures. Both of these requirements restrict the discharge of any drilling mud containing oil. The U.S. Minerals Management Service Orders states, "if any oil base mud is used, the mud would not be released to the ocean, and cuttings would be cleaned or barged to shore for disposal."

Discharge of Formation Water. Formation water is recovered along with oil during petroleum production. Formation water is derived from water that was laid down within the sediments in the geological past. During the compaction, some of this interstitial water (connate water) was displaced from the resulting formation to form formation water. Consequently, formation waters reflect their environment of deposition.

After separating oil from formation water, the formation water may be disposed of by injecting into disposal wells (wells drilled for the purpose of storing formation water), reinjected into producing formations, discharged into the marine environment, or a combination of these three disposal methods. Traditionally, Southern California OCS formation waters have been discharged into the marine environment.

During initial oil production, formation water volumes will represent a small fraction (less than 1 percent) of the total fluid extracted from the well, with oil composing almost the entire amount of fluid. As the reservoir is depleted, the ratio of formation water to oil increases to as much as 3 to 1. Formation water volume estimates are shown in Table IV.A.8.a-1.

Based on a small amount of data, the oil field formation waters of the California coastal region range from 22 ppt to 40 ppt mineral salts. The most common chemical constituents found in formation waters are iron, calcium, magnesium, sodium, bicarbonate, sulphates, and chloride. In addition to these chemical constituents, formation waters contain entrained oil or petroleum hydrocarbons, numerous trace elements, and an absence of dissolved oxygen.

Table IV.A.8.a-4 shows the range in chemical constituent concentration of formation water encountered from wells along the California coast.

Sewage. The estimated annual discharge of sewage from the proposed oil and gas activity is shown in Table IV.A.8.a-1. OCS Order No. 8 states "following sewage treatment, the effluent shall contain 50 ppm, or less, of suspended solids, and shall have a minimum chlorine residual of 1.0 mg/liter after a minimum retention time of 15 minutes". The daily volume of sewage that will be discharged will range from 3,800 gallons/day to 19,000 gallons/day. Sewage discharge was estimated as 100 gallons/day/person on the platforms.

Hydrocarbon Discharges. Hydrocarbons may be discharged into the marine environment as a result of accidental spills. The volume of oil which enters the marine environment will depend on the type of accident and is very difficult to predict. Once the oil enters the ocean a variety of physical and chemical processes act to disperse the oil slick including spreading, evaporation of the more volatile constituents, dissolution into the water

TABLE IV.A.8.a-4

CALIFORNIA OFFSHORE PRODUCED FORMATION WATER
Constituents Range[a]

Formation Water Constituent	Concentration (mg/l)
Salinity	
(Total dissolved solids)	21,700 - 40,400
Suspended solids/turbidity	
(Untreated water)	30 - 75
Oxygen Demand	
BOD (5-day)	370 - 1,920
COD	340 - 3,000
Oil and Grease	56 - 359
Trace Contaminants[a]	
Arsenic[a]	0.001 - 0.08
Cadmium	0.02 - 0.18
Total Chromium	0.02 - 0.04
Copper	0.05 - 0.116
Lead	0.0 - 0.28
Mercury	0.0005 - 0.002
Nickel	0.100 - 0.29
Silver	0.03 -
Zinc	0.05 - 3.2
Cyanide	0.0 - 0.004
Phenolic Compounds	0.35 - 2.10

Source: EPA, 1974.

[a]Some data reflect treated waters for reinjection.

NOTE: Due to the limited data from California offshore wells, these values represent estimated constituent values.

column, emulsification of small droplets, agglomeration and sinking, microbial modification, photochemical modification, and biological ingestion and excretion. The rates at which the oil is removed from the ocean will depend on water temperature, current movements which may spread dissolution, wind speed which may aid evaporation and physical mixing by wind waves. A more complete discussion of these factors is found in Malins (1977) and Wolfe (1977).

In addition to the larger spills from accidents, some oil is expected and observed around drilling and production operations. These volumes are probably less than one barrel per day, resulting from small amounts of oil remaining on cuttings, after washing, small amounts spilled when hoses are uncoupled and amounts accidentally discharged from work boats. It should be noted that production platforms are provided with below deck pans and tubing to catch and funnel small amounts of oil which may be related to the drilling equipment for proper disposal onshore. These small amounts of oil are sometimes seen as a sheen on the water near the platform, dissipate within several meters to several hundred meters and are generally considered an insignificant input of hydrocarbons.

b. Effects on Marine Life (Effluents): The effects on marine life of materials other than petroleum hydrocarbons (discussed in Section IV.A.4.c) which are introduced into the ocean are discussed in this section. Resuspended bottom sediments, discharged sewage, drilling fluids (muds and cuttings), and formation water may all have impacts on marine biota. The following discussion will focus on the effects of drilling fluids and formation water because of the much larger volumes involved with these compared to resuspended sediments or sewage. In addition, the effects on marine life from resuspended sediments would primarily be through turbidity or smothering effects and thus the conclusions or research regarding muds and cuttings effects would apply to sediment perturbations.

Drilling mud will be discharged into the ocean as described in Section IV.A.8.a. The fate and effect of mud has been discussed at length in the FEIS for OCS Lease Sale No. 53 (BLM, 1980) and in the Symposium on Research on Environmental Fate and Effects of Drilling Fluids and Cuttings (Courtesy Assoc., 1980), Dames and Moore (1980), Neff (1981), and Petrazullo (1981). In addition to the above reviews, the National Academy of Sciences is conducting a review of available research results and should issue a report in late 1982 or early 1983.

Direct impacts of drilling muds and cuttings are via smothering or toxicity of mud components. Some coral species and sea anemone species exist in the Proposed Sale No. 73 area and these may be sensitive to smothering by muds and cuttings. Experiments by Shinn, et al., (1980) indicate short-term (acute) toxicity of approximately 500 ppm for the corals Montastrea annularis and Agaricia agaricites. The research indicated corals could survive short-term impacts within 6 m of a mud discharge. However, other research (Hudson and Robbin, 1980; Thompson and Bright, 1980; Kune and Biggs, 1980) showed sublethal effects could be very damaging to corals within an estimated distance of 3 m. It is, therefore, expected that the smothering and/or sublethal impacts to sensitive corals and anemones would be possible in the Proposed Sale No. 73 area. This may apply to hard bottom (rocky outcrops) substrates within the sale area.

The toxicity of drilling mud is debated among groups concerned with OCS

impacts. The data to date, although suffering shortcomings in several cases, indicate that muds have low toxicity when compared to petroleum hydrocarbons, trace metals dissolved in sewage, or industrial wastes. This conclusion is based primarily on short-term, 96-hour static bioassays of used drilling muds and drilling mud components. Research has also included a number of sublethal and long-term (106 day) experiments with a range of invetebrates (crustaceans, annelids, mollusks). The sublethal and long-term study data tend to support the conclusion of low toxicity of muds but some data indicate interference with growth in oysters and pectens at concentrations of 100 ppm. Differences in results are probably due in part to differences in muds tested. Whether these latter results are due to toxic or mechanical properties of the muds is open to question. A field study of the effects of mud and cuttings discharge from exploratory wells is expected to start in the near future in State of California waters in the Santa Barbara Channel. The study will be funded by oil companies operating on leases in State waters as part of the conditions specified in the NPDES permits administered by the State of California. The results of this study should provide data on the effects of muds and cuttings on endemic fauna of the area and subsequently allow comparisons to be made between this study and similar studies in the Georges Bank, Lower Cook Inlet, Mid-Atlantic Shelf, and Gulf of Mexico regions already completed or ongoing.

Formation water will be discharged as described in Section IV.A.8.a and may affect both water quality (Section IV.E.1.a) and marine life (see Section IV.E.2). The number of studies of the effects of formation water on marine organisms is much less than those for drilling muds and cuttings. The primary concern regarding biological effects of formation water center on the trace metal content, hydrocarbon content and oxygen demand of this discharge and the potential for these discharges to add pollutants or reduce oxygen in the ocean. Table IV.A.8.a-4 (Section IV.A.8) lists the characteristics of California formation waters, Table IV.E.1.a-1 and a-2 give the ambient sea concentrations, safe levels, estimated metal concentrations at 1,000-fold dilution, and EPA 24-hr. criteria. The figures concerned with EPA criteria levels of metals represent composites drawn from a large number of tests on a wide variety of organisms (NAS, 1972; EPA Quality Criteria for Water, 1972). The 96-hour LC_{50} values (the concentration of pollutant at which 50 percent of the test organisms die in 96 hours) for toxicity of different metals varied with the organism tested, the life stage, and the method of applying the toxic substances. The levels indicated in Table IV.E.1.a-2 are conservative and below published levels for acute toxicity.

Acute toxicity of formation water was investigated by Zein-Eldin and Keney (1978) and Rose and Ward (1980). The earlier study reported 96-hr. LC_{50} values for juvenile white shrimp of 1,750-6,500 ppm formation water and a second set of data showing 96-hr. LC_{50} values greater than 100,000 ppm. The first set of values were obtained using formation water treated with two biocides while the second data set was obtained from untreated formation water. The lowest 96-hr. LC_{50} values obtained by Rose and Ward were 7,000-8,000 ppm formation water for larval brown shrimp. This formation water had a high oxygen demand relative to the conditions around the real discharge in the Buccaneer Field. It seems, therefore, that acute toxicity of formation water may be associated principally with removal of oxygen from seawater or indirectly by biocides added to waters prior to discharge.

Mackin (1971) studied the effects of oil field brine discharges (formation water) on benthic communities in Texas estuaries and bays. He found changes in benthic fauna (decreases in diversity and numbers of individuals) at distances out to approximately 400 feet. Beyond this distance the communities were normal.

The long-term sublethal effects of formation water are unknown (beyond the lack of obvious effects in historical producing areas such as the Gulf of Mexico) although the sublethal effects of trace metals on organisms are known for a variety of metals and marine organisms (e.g., Reish, et al., 1976; Oshida, et al., 1981). Galloway, et al., (1980) studying the fouling community on platforms in the Buccaneer Oil Field and the associated reef and demersal fishes found reduced biomass and production levels in the fouling community restricted to one (1) meter vertically and 10 meters horizontally on the platform. Galloway found elevated alkane levels in sheepshead collected near the platforms but less than normal histopathological anomalies (fish were "healthier" near the platforms). Crested blemmies around the platforms showed results similar to the sheepshead; spadefish showed no evidence of petroleum or trace metal contamination attributable to Buccaneer Field operations; and red snapper showed gill hyperplasia in 62 percent of the fish collected. However, more work was needed to understand the population dynamics of the red snapper and the correlation between red snapper gill abnormalities and formation water discharge may or may not be real.

c. Air: This section describes significant emissions of air pollutants associated with typical OCS activities. Air pollutants discussed include nitrogen oxides (NO_x), carbon monoxide (CO), sulfur oxides (SO_x), total suspended particulates (TSP), volatile organic compounds (VOC)* and hydrogen sulfide (H_2S). Ozone (O_3) is not emitted directly by any source, but is formed in a photochemical reaction in the atmosphere involving VOC and NO_x. The pollutants are regulated by Federal and State agencies to prevent adverse effects on human health and welface (See Section III.A.9).

NO_x consists of both nitric oxide (NO) and nitrogen dioxide (NO_2). NO_x is formed through the combination of oxygen and nitrogen in the air during combustion processes, and the rate of formation increases greatly with combustion temperature. Most emissions would initially be in the form of NO. NO will slowly oxodize in the atmosphere to form NO_2. NO_x and VOC perform a vital role in the formation of photochemical smog. NO_2 breaks down under the influence of sunlight producing NO and atomic oxygen (O), which then combines with diatomic oxygen (O_2) to form O_3, or with VOC to form various gaseous and particulate compounds that result in the physiological irritation and reduced visibility, typically associated with photochemical smog. Photochemical smog is by far the most serious air pollution problem in many urbanized California coastal areas.

CO is formed by incomplete combustion. It is mainly a problem in areas of where there is a high concentration of vehicle traffic. CO can have an adverse health effect on humans.

SO_x is formed in the combustion of fuels containing sulfur. Emissions are usually in the form of sulfur dioxide (SO_2). SO_x in the atmosphere slowly connects to sulfate particles. SO_x in the presence of fog or clouds may produce sulfuric acid mist. Entrainment of sulfur oxides or sulfate particles into storm clouds may be significant contribution to reduced pH levels in precipitation (acid rain).

TSP emissions associated with combustion consist of small particles (less than 10 microns in diameter). Particulates, especially those in the size range of 1 to 3 microns can cause adverse health effects. Particulates in the atmosphere also tend to reduce visibility.

H_2S is a gas that has a characteristic "rotten egg" odor. It is sometimes associated with oil and gas processing. H_2S is dangerous at high enough concentrations. H_2S in the atmosphere gradually oxidizes to form SO_2.

The type and relative amounts of air pollutants generated by offshore operations varies according to phase of activity. There are basically three phases: the exploration phase, development phase, and production phase. For a more detailed discussion of emission sources associated with each phase, refer to Form and Substance, 1983. Significant emission sources are summarized below.

* VOC is defined as any hydrocarbon compound, excluding those that are unreactive (such as methane and ethane).

Offshore Emissions

Exploration Phase. Emissions would be produced by 1) diesel-fired power generating equipment needed for drilling exploratory and delineating wells, 2) tug boats, supply boats and crew boats in support of drilling activities, and 3) intermittent operations such as mud degassing and well testing. Pollutants generated would primarily consist of nitrogen oxides (NO_x), carbon monoxide (CO), and sulfur oxides (SO_x).

Development Phase. The primary offshore emission sources would be 1) diesel or natural gas driven turbines used to provide power for drilling, 2) heavy construction equipment used to install platforms and pipelines, and 3) tug boats and supply boats. The principal development phase emissions would consist of NO_x with lesser amounts of SO_x, CO and total suspended particulates (TSP).

Production Phase. A significant source of offshore emissions would be due to power generation for oil pumping, water injection, and gas compression. The emissions would consist primarily of NO_x with smaller amounts of TSP and CO. Another significant source of air pollutants would be evaporative losses (VOC) from oil/water separators, pump and compressor seals, valves, and storage tanks. Venting and flaring could be an intermittent source of VOC, SO_x, and hydrogen sulfide (H_2S). Gas processing, which involves gas-liquid separation, dehydration, and desulfurization would result in emissions of VOC, NO_x, SO_x, and sometimes H_2S.

Another source of offshore emissions would be from barges or tankers. Significant emissions would consist of 1) VOC losses from loading crude oil; 2) exhaust emissions from burning residual oil or diesel fuel in the ship's engines and pumps; and 3) VOC breathing losses from cargo tanks while the ship is in transit. Purging or gas-freeing of cargo tanks generates high levels of VOC. However, this is an action which would be rarely performed. The primary pollutant generated by tanker of barge activity would be VOC emissions associated with loading of crude oil. Exhaust emissions would be a significant source of NO_x and SO_2.

Onshore Emissions

Exploration Phase. Onshore emission sources would consist of vehicles transporting personnel and materials, and support vessels operating in the harbors. Pollutants generated in this phase of development would primarily consist of NO_x, CO, and SO_x.

Development Phase. Significant emissions would consist of 1) crew and supply boats, 2) support vehicles, and 3) construction activities associated with gas processing facilities and pipelines. Emissions would primarily consist of NO_x, CO, TSP and SO_x.

Production Phase. Onshore emission sources would consist of 1) gas processing facilities, 2) tanker activities at unloading site, 3) crude oil storage, 4) pipelines, and 5) refineries.

Emissions from gas processing facilities would be similar to those described under offshore sources. Tanker emissions would primarily consist of exhaust emissions (NO_x and SO_2) from the ship's engines and VOC losses associated with tanker loading operations.

Pipelines would emit minor quanitities of pollutants at each end of the pipeline where there are pumps, compressors valves, and related equipment. Pollutants would consist primarily of VOC and NO_x.

Crude oil may be stored in floating roof tanks or in fixed roof tanks equipped with a vapor balance line. Emissions from floating roof tanks would consist of standing losses and withdrawal losses. Standing losses would be from vapor escaping due to pressure differences. Withdrawal losses would be due to evaporation of hydrocarbons clinging to the tank wall as the floating roof descends. Emissions from tanks equipped with a vapor balance line would be very small.

Emissions would also result from refining the crude oil. It is anticipated that no increase in refinery capacity would be needed in California as a result of the Proposed Lease Sale No. 73. However, changes in emissions may result because the crude oil produced from offshore activities have different properties from the crude oil being refined presently. Offshore crude oil tends to have a higher sulfur content than oil currently being handled by the refineries. Installation of pollution control equipment or modifications of the processing facilities may be necessary to prevent an increase in emissions of sulfur compounds.

Summary of Emissions. Table IV.A.8.c-1 lists the maximum projected annual emissions associated with Proposed Sale No. 73. Emissions are given for the peak exploratory, development, and production years.

Emissions of NO_x, CO and TSP tend to reach a maximum during the peak development year. The primary emission sources would be crew boats, supply boats, and heavy construction equipment used in the installation of platforms and pipelines. Emissions of VOC and NO_x would reach a maximum during the year of greatest production.

9. Changes in Economic Activity: The California economy in 1982 is expected to follow the national recessionary trend, but with milder impacts. The economic slowdown has affected various sectors of the economy differently.

Employment losses are widespread throughout the economy. Construction employment has been the hardest hit, reflecting the prolonged slump in homebuilding and slowdown in commercial construction activity. Durable goods and retail trade have also shown deep declines in the past year. Agriculture is faced with two main problems: poor economic performance results in a decline in demand, while recent good crops have produced a downturn pressure in prices. Showing resistance to the recession are the finance group, mining, and wholesale trade all of which have shown some increase in employment. Total employment in the State will grow by 1 percent to 10.8 million in 1982. The unemployment rate will average 8.5 percent for the year, from 7.4 percent in 1981, which has been below the national average. Unemployment will peak in the 9.0 percent range before it declines toward the end of the year.

TABLE IV.A.8-1. ESTIMATED MAXIMUM ANNUAL EMISSIONS
PROPOSED OCS SALE NO. 73[1]

	Emissions (tons/year)				
	VOC	NO_x	SO_x	CO	TSP
Exploratory Phase[2] (1985)					
Exploratory Drilling	41.6	319.2	18.0	44.2	19.4
Support Vessels	1.3	60.2	4.1	9.0	2.4
Development Phase[3] (1989)					
Development Drilling	8.1	103.9	5.4	23.6	7.7
Platform Installation	16.2	333.9	22.5	61.5	19.3
Pipeline Installation	5.3	86.2	5.8	17.2	5.5
Production	65.9	176.6	1.5	139.8	10.5
Support Vessels (Development)	9.4	435.0	29.6	65.2	19.2
Support Vessels (Production)	3.7	169.8	11.6	25.5	7.5
Tankers in Port (Gaviota)	6.3[4]	2.6	3.6	0.6	0.5
Tankers in Port (San Francisco)	0.4[4]	1.2	1.5	0.3	0.2
Production Phase[5] (1993)					
Production	153.4	643.1	4.7	448.9	35.8
Tankers in Port (Gaviota)	19.2[4]	7.9	10.8	1.8	1.4
Tankers in Port (San Francisco)	1.1[4]	3.6	4.6	0.8	0.6

1. Calculation made by MMS based on data provided by Form and Substance (1983a,b).

2. Peak exploratory activity in year 1985, assumes 3 exploratory and 4 delination wells drilled.

3. Peak development activity in year 1989, assumes 49 development wells drilled, 2 platforms installed, 46 miles of pipeline laid, and 4 platforms producing 6,650 BOD and 6,500 MCFD each. Tanker traffic out of Gaviota would consist of 8 roundtrips by 45,000 DWT tankers to Galveston and 13 roundtrips by 27,000 DWT tankers to San Francisco.

4. It is assumed that VOC emissions from tanker loading or unloading activities would be controlled using vapor balance lines, providing a control efficiency of 95 percent.

5. Peak production activity in year 1993, assumes 5 platforms would produce 16,860 BOD and 16,420 MCFD each. Tanker traffic would consist of 24 roundtrips by 45,000 DWT tankers to Galveston and 39 roundtrips by 27,000 DWT tankers to San Francisco.

Disposable income for most people will rise due to a lower inflation rate of about 8 percent down from 10 percent in 1981. Also, the 10 percent tax reduction in personal income taxes which takes effect on July 1st is expected to have a big impact on disposable income. Gains indisposable income will spur consuming spending, which, in turn, would result in an increase in overall economic activity.

Because of California's specialization in aerospace and electronics, the State normally captures 20 percent of the nation's defense procurement dollars and 30 percent of research and development spending. In fiscal year 1982, defense and R & D authorizations nationwide will total $90 billion over 1981, of which California should receive about $18.5 billion. This increase in defense spending will have a favorable impact on the California economy as employment in these areas will rise.

10. Effects of the Physical Environment on Oil and Gas Operations

a. Geologic Hazards: Geologic hazards are any geologic features or processes, existing or potential, that would inhibit the exploration and development of petroleum resources. Geologic hazards that are recognized on the central-northern California continental margin are a) areas of high incident of seismic activity; b) active faults; c) mass movement of unconsolidated to semi-consolidated sediments; and d) steep slopes (> 10°) and steep-walled submarine channels (Richmond et. al., 1981). These hazards may present many operational limitations to the exploration and development of oil and gas. Therefore, adaptations in the placement, structural engineering, routing of pipelines, exploratory drilling and production platforms may be necessary. Geologic hazards which are hazardous in their present state, but whose effects can be feasibly lessened through existing technology and design pose engineering (constraints) to oil and gas development. These hazards identified offshore central-northern California are a) filled or shallow-buried channels; b) hydrocarbon seeps, seep mounds and gas craters; c) gas-charged sediments, and d) pressurized shallow gas zones.

A basin-by-basin analysis of the geologic hazards is presented in Section III.A.1.b. In addition, the data presented on the geologic hazard and the geologic structure visuals represent the compilation of data collected over a period of 12 years. The bulk of the data was collected aboard U.S. Geological Survey research vessels on recent cruises funded by MMS (McCulloch, 1982). These visuals provide a regional scale representation of the geologic hazards, geologic structures, and seismicity for central-northern California.

Seismicity and Faulting. The central-northern California OCS is cut by numerous faults that represent a potential for strong ground motion. Many of these faults are not considered hazardous to hydrocarbon development except where they are considered active. Faults are considered active if recent sediments are offset where sedimentation has been continuous, if they intersect or offset the seafloor, or if they have a historic record of earthquake activity (Richmond and Burdick, 1981). Active faults are hazardous to man-made structures in terms of ground motion, producing seafloor instabilities and ruptures of the seafloor.

Mass Movement. Three types of mass movement of sediments are recognized: slides, stumps and creep. A slide is the descent of a rigid or semi-consoli-

dated mass with little internal movement. A slump is the rotational sliding of sediments. Creep is the very slow and nearly continuous downward gravity-induced movement of sediments.

Gravity is the major contributing force for mass movement of sediments on marine slopes. Unconsolidated sediments are stable with regard to gravity forces where the slope equals the friction angle of the sediments. The occurrence of sediment failure on very gentle slopes - 0.25 degrees (Field, et al., 1982) indicate that external foces contributed to the failure.

Local seismicity can cause sediment failures (Edwards, et al., 1980, and Field, et al., 1982). Earthquakes can cause additional shearing stresses and increase pore-water pressures resulting in the failure. Additional causes of mass movement is overloading, or oversteeping of slopes, high gas content in shallow sediments and storm surges.

Structures sited on the seafloor near major active faults may experience sediment failures.

Steep Slopes/Steep-Walled Canyons. Slopes are arbitrarily classified as flat, gentle, moderate or steep. Flat slopes are defined as the horizontal sea floor. Slopes less than 5 degrees are considered gentle, slopes of 5-10 degrees are moderate, and slopes greater than 10 degrees are steep. Only steep-walled canyons and steep slopes are considered to be hazards, especially those with sediment cover.

Buried Channels. Buried channels are identified by irregular erosional contact between younger and older sediments. The channels were cut during periods of lower sea levels and have been subsequently buried by transgressing seas. The infilling sediments in the channels may show crossbedding or unconformable bedding. Shallow-buried channels are considered to be constraints because the load-bearing capacity may differ between the younger and older sediments. In addition, bearing capacity within the buried channel can vary. Channel fill, if permeable can cause the loss of drilling fluids during drilling operations.

Hydrocarbon Seeps. Hydrocarbon seeps result from the upward migration of oil and gas from deeper reservoirs. Gas seeps in association with bedrock outcrops, steeply dipping beds, and faults are considered constraints to development. The near-surface geologic structures act as conduits from possible pressurized zones at depth. If these structures are intercepted during drilling they can act as possible escape routes for hydrocarbons.

Gas-Charged Sediments. Gas-charged sediments are unconsolidated to semi-consolidated sediments saturated with gas under normal or near-normal pressures. Gas-charged sediments are considered constraints due to large differences in load-bearing capacity which may exist between the gas zone and surrounding sediments. The ability of these sediments to support man-made structures may be significantly reduced. The presence of the gas can also result in liquifaction or cause the sediments to be more susceptible to failures due to seismic ground motion.

Shallow Gas. Shallow gas zones refer to confined gas accumulations with possible abnormal-pore pressure. Shallow gas may be biogenic in origin from the decomposition of organic material. It may also be by gas trapped in sediments after migrating upward from deeper reservoirs.

Subsidence. Withdrawal of fluids from the oil zones, with the consequent lowering of reservoir fluid pressures, may cause reservoir compaction and eventual ground surface subsidence. Although certain geologic conditions can cause subsidence (i.e., a thick, shallow, unconsolidated sand section, high porosities, interbedded fine-grained soils), the principal controlling factor is pore-fluid pressure. Significant reduction in the natural pore-fluid pressure (e.g., from fluid withdrawal) may result in the transfer of load from the pore fluids to the internal structure of the formation, and subsequent compaction of the soils.

OCS Orders and Regulations (30 CFR 250). Exploratory drilling operations, emplacement of structures (platforms) or seafloor wellheads for production or storage of oil or gas, and the emplacemment of pipelines will not be allowed within the potentially unstable portion of this lease block unless or until the lessee has demonstrated to the Regional Supervisor Offshore Field Operations Division (RSOFOD) satisfaction that mass movement of sediments is unlikely or that exploratory drilling operations, structures (platforms), casing, wellheads and pipelines can be safely designed to protect the environment in case such mass movement occurs at the proposed location This may necessitate that all exploration for development of oil or gas be performed from locations outside of the area of unstable sediments, either within or outside of this lease block.

If exploratory drilling operations are allowed, site specific surveys shall be conducted to determine the potential for unstable bottom conditions. Also, an extension of these surveys may be required outside of the leased block. If emplacement of structures (platforms) or seafloor wellheads for production or storage of oil or gas is allowed, all such unstable areas must be mapped. The RSOFOD may also require soil testing before exploration and production operations are allowed.

The existing regulations require the lessees to conduct site specific surveys prior to any approval of exploration and development actions. Exploration permits require 2000 ft. grid geologic hazard surveys. The hazard surveys provide the MMS geophysicists with information to determine slope, faulting, natural gas seeps, possible high pressure zones, old river channels, and unconsolidated sediments and slope stability. From the report the geophysicists prepares on this information, the MMS engineer will determine if geological conditions are acceptable for exploration operations. If the geological information indicates conditions too severe for exploration, the exploration plan will not be approved or the operators will be required to move their exploration site to an area safe for exploration.

Permits for all platforms require a geological hazard survey similar to the exploration survey, except the survey is done on a more detailed grid. Additionally, MMS requires soil analyses to determine if the soil can support the platform. From the geophysicist's report, the MMS engineer determines if the geologic conditions are suitable for the placement of a platform. If

the geological information indicates conditions too severe for platform placement, the platform plan will not be approved or the operators will be required to move their platform placement site to an area safe for platform placement.

Additionally, the platform plans must go through a Platform Verification Program. The Platform Verification Program is a mandatory and integral part of the review and approval process for Plans of Exploration and Plans of Development/Production in addition to addressing platform design, fabrication, and installation. The major thrust of the Program assures that new fixed or bottom-founded oil and gas platforms in frontier areas can function safely in unusual or extreme environmental conditions. In addition to the review by the MMS Platform Verification Program Committee, an independent review is completed by an expert outside the Federal government. Independent third-party experts are evaluated and certified by the USGS on the basis of technical competence and demonstrated experience in offshore engineering. They are then placed on an approved list and selected by the lessee. The technologies involved in implementing the Program entail representation from such diverse disciplines as structural engineering, soil mechanics, geology, geophysics, oceanography, meteorology, hydrodynamics, quality assurance, statistics, and computer science.

In addition to the Platform Verification required under OCS Order No. 8 all the OCS Orders and other regulations under 30 CFR 250 are important in maintaining safe and proper OCS oil and gas operations. OCS Orders 2, 5, 6, 8, and 9 and 30 CFR 250.12 and 30 CFR 250.41 are specifically important in ensuring oil and gas operation on the tracts listed above will be explored and developed in a safe manner.

OCS Order 2 pertains to drilling operations. This order basically specifies the regulation for drilling wells; types of blow out prevention equipment required, type of mud, casing and cement programs required under varying geologic conditions; and training all operators must have for crews.

OCS Order 5 pertains to production safety system. This order basically requires the use of best available and safest technology; safety equipment, work done under standards formulated by reputable societies (API, ASME, APPE); and the requirement for down hole safety device. The down hole safety device will automatically close in upon failure, thus in case of well rupture the well sould shut in and gas and oil would be stopped from moving to the surface.

OCS Order No. 6 basically supports OCS Order No. 2.

OCS Order No. 8 pertains to platforms and structures. This OCS Order basically requires the platform verification program.

OCS Order No. 9 pertains to pipelines. This Ocs Order is similar to Ocs Order No. 8 but it pertains to pipelines. The Order requires that the pipeline systems are designed to withstand those conditions will be subjected to.

30 CFR 250.12 pertains to the USGS Director's authority to suspend production or other operations. The Director has the authority to suspend production or other operations if lessee violates any applicable law, regulation OCS Order,

or condition of permit, or if continued operation posses a threat of serious harm to life or the environment.

The lease may be cancelled if the Secretary determined that continued operation would pose serious harm to life or the environment and the threat of harm will not disappear or decrease to an acceptable extent within a reasonable period of time.

30 CFR 250.41 pertains to well control. This regulation requires the lessee to control the well at all time.

The above regulations and OCS orders provide adequate means to mitigate the geologic hazards within the proposed sale area. Attaching geologic hazards stipulations to the leased tracts would not provide any additional mitigation.

Exploration And Production Technologies. Petroleum exploration and production technologies have been developing rapidly. As more and more development takes place, various engineering adaptations to platform structures and pipeline laying, and the proposal of alternatives for platform sites and pipeline routes have been developed.

Petroleum engineers design platforms in accordance with OCS Order No. 8 to withstand dynamic loads caused by severe storm waves, earthquakes, and stress/strain during launching and installation. Particular emphasis is given to design criteria based upon the geologic hazard/constraint and soil stability analysis.

When a platform is in an area of recognized seismicity all structures are required to be designed for an earthquake environment.

Two earthquakes of different levels are generally postulated for seismic design. The lower level Design Earthquake is the earthquake that is reasonably expected to occur during the life of the structure. The Design Earthquake is designated as the 200-year event. The Maximum Credible Earthquake is the maximum earthquake expected to occur. This earthquake is based upon the largest peak ground acceleration.

To determine the Design Earthquake and the Maximum Credible Earthquake for the site, a review of the geology, tectonics and seismic history of the region and the positions of the epicenters of the major earthquakes is performed. Based upon this data, a statistical reoccurrence relationship is developed for each possible seismic event in the area. This information is used in determining the Design Earthquake. The Maximum Credible Earthquake will be governed by either a fault related event or an event associated with regional tectonics. The worst case fault related event in the area is based upon an epicenter postulated to occur on the fault trace nearest the platform site. These events are then used to determine the peak horizontal ground acceleration for the area.

Design specifications are then based upon ground accelerations so the platform could resist shaking, without damage and withstand ground motion without collapse.

Various conditions, mass movement sediment transport, and faulting can cause bottom instabilities. An interdisciplinary study of the platform site by geologists, seismologists, oceanographers and soil engineers can provide the information needed for design specifications. Information required for the evaluation of the expected soil response consists of regional and site-specific geology of the area, shallow and deep geophysical data, past, present and future environmental conditions, both coring and in situ testing of the soils, and results of analytical models.

The economy and safety of platform design can be improved by the early identification of geologic hazards and constraints. In many instances the relocation of drill sites and platforms can mitigate the potential hazard. The danger of subsidence due to fluid withdrawal is controlled by a pressure maintenance program using water injection. This program is usually begun after the start of production and will continue throughout the life of the field.

Offshore pipelines must be designed to withstand numerous hazards during their lifetime. Design criteria include corrosion, geologic hazards, hydrodynamic forces, and accidental damage caused by anchors and other objects.

Data required to determine design specifications is acquired in a similar fashion as for platforms.

b. Physical Oceanography: The physical oceanographic forces of currents and waves are believed to pose no threat to the physical integrity of drilling rigs or production platforms used offshore. Oil and gas structures have been engineered to withstand the maximum expected currents, which are typically less than 40 cm/sec in the lease sale area, and also the 100-year expected storm waves, which are less than 10 meters in the area. Storms and associated waves may cause cessation of some activities on rigs and platforms because of the danger to personnel transfer from shore boats or the danger and spill hazards involved in off-loading oil from platforms to tankers (if this method of transportation is selected). This is only expected to occur in areas greater than 3 meters (personal communication by Exxon handle platform personnel). Bottom currents are not expected to affect the transportation of oil and gas by pipeline.

c. Meteorology: The Central California coastal waters experience a high frequency of restricted visibilities that could occasionally hinder the movement of crew boats and supply vessels. The frequency of restricted visibility for each OCS Basin is presented in Section III.A.8. However, dense fog would seldom be expected to last long enough to cause significant delays in OCS operations.

Strong winds are infrequent, although in winter season, occasional periods of strong winds and high waves may disrupt construction activities or the movement of crew or supply boats. However, these conditions seldom persist for more than one or two days. Thunderstorms generally occur less than a few times a year. Tornadoes or freezing condition zre virtually unknown.

B. Mitigating Measures that are Part of the Proposed Action

1. OCS Operating Orders: OCS Orders are mandatory requirements and specifications for oil and gas exploration and recovery operations that supplement other regulations. Orders outline permit requirements, engineering criteria, surveillance, testing procedures, and information requirements. Pacific OCS Orders are administered by MMS and contain regulations which have been designed to help ensure the safety of operations and personnel and to minimize the risk of environmental damage. Conformance with these orders is regularly monitored by MMS personnel. MMS conducts daily inspections (either announced or unannounced) of all exploratory functions and it conducts semi-annual inspections of all platforms in the Pacific OCS region. Pollution surveillance flyovers of platforms, pipeline routes, and exploration operations are made weekly. The staffing size of the inspection program will be proportional to the exploration and development activities. The following is a brief description of each Pacific OCS Order:

OCS Order No. 1. This order requires identification of the operator, block designation and well number on platforms, structures, wells and mobile drilling units. It requires that the U.S. Coast Guard District Commander determine what aid-to-navigation devices are needed for subsea objects that are hazards to navigation or to the deployment of commercial fishing devices. It requires that èquipment of sufficient size or of such a nature that it could be expected to interfere with commercial fishing gear, if dropped overboard, be marked, wherever practicable, with the owner's identification.

OCS Order No. 2. This order details drilling operation rules and permit requirements, including those for mobile drilling units (including fitness and ability to withstand oceanographic and meteorological conditions). It includes criteria relative to inspection of all fixed and mobile drilling units; required hazards report and other surveys as necessary; well design, casing, and cementing; blowout-preventer equipment requirements; mud program; supervision, surveillance and training; criteria operations and curtailment plans; and for the establishment of field drilling rules.

OCS Order No. 3. This order establishes plugging and abandonment procedures which have general application to all wells drilled for oil and gas. All casings, wellhead equipment, and pilings must be removed to a depth of at least 5 meters (16 feet) below the ocean floor unless another depth is approved by the Minerals Manager.

OCS Order No. 4. This order sets out criteria for demonstrating the capability of a well to produce paying quantities of oil or gas.

OCS Order No. 5. This order contains detailed procedures for the operation of surface production safety systems; subsurface safety devices; additional safety and pollution-control requirements; and crane operations. The Failure and Inventory Reporting System (FIRS) is outlined, as are employee orientation and motivation programs.

OCS Order No. 6. This order sets specifications and testing procedures for completed wells and for multiple or tubingless completions. It relates to production operations only.

OCS Order No. 7. This order requires that the lessee prevent pollution of the ocean, prescribes certain pollution control measures, outlines requirements for Oil Spill Contingency Plans, and prohibits disposal of any waste materials into the ocean that will create conditions which will adversely affect the public health, life, property, aquatic life, wildlife, recreation, navigation, commercial fishing, or other uses of the ocean. Disposal of waste materials is regulated by the Environmental Protection Agency pursuant to the Federal Water Pollution Control Act, as amended.

OCS Order No. 8. This order establishes requirements applicable to platform and structure design and installation. It requires consideration of environmental conditions which may contribute to structure damage. This order applies to production operations.

OCS Order No. 9. This order for the Pacific Area OCS provides approval procedures for oil and gas pipelines on the OCS. All pipelines and related equipment must be designed and maintained with high-low pressure sensors, automatic shut-in valves, checkflow valves (to control backflow), and metering systems. The Order also requires adequate provisions for cathodic corrosion protection, trawling compatibility, hydrostatic testing, storm scour and other environmental stress in OCS pipelines. Procedures and schedules for regular inspection of pipelines along with recording of such inspections are stipulated.

OCS Order No. 10. This order provides for drilling twin core holes located adjacent to core holes drilled on the OCS under earlier California State authorization. Such holes were drilled prior to the establishment of Federal authority beyond the 3-mile limit.

OCS Order No. 11. This order sets requirements for maximum efficient recovery rate for oil and gas from a lease, and establishes production rates. It also provides procedures to shut-in wells, due to over-production or storms, and for producibility tests. It applies to production only.

OCS Order No. 12. This order sets forth requirements for public inspection of records. It details what information, which the lessee provides to the Minerals Management Service, is considered public and how this information should be transmitted to MMS in order for it to be made publicly available.

2. Oil Spill Cleanup and Containment

a. Capabilities: Minimizing potentially negative impacts to the environment from offshore oil spills has been a prime concern of government and industry for many years now. As a result, stricter environmental regulations have been issued, oil spill cleanup devices have been improved, and research efforts continued for more efficient cleanup techniques.

The regulations addressing cleanup include the U.S. Department of the Interior Pacific OCS Orders governing oil and gas lease operations (January, 1980). Order numbers 2, 5, 7, and 8 specifically address oil spill contingency planning, personnel training requirements, and the maintenance of on-site oil spill containment and recovery equipment. The on-site equipment requirements include 1,500 feet of open-ocean boom with deployment and recovery capabilities. In addition to these operating orders, a memorandum-of-understanding

(MOU) commandant notice No. 5740 between the U.S. Coast Guard (the leading agency pre-designated as on-scene coordinators for OCS oil spills) and the U.S. Geological Survey (now the Minerals Management Service) specifically lists guidelines for contingency planning and cleanup ability requirements. This MOU is effective June 1, 1982, and is included in Appendix C.

There is a large number of cleanup devices available commercially, including oil spill booms (both open-ocean and harbor), skimmers, oil/water separators, pumps, sorbents, and chemical dispersants. The current cleanup capabilities (specifications) of the mechanical devices now available are very controversial. The manufacturers report that heavy-duty open-ocean booms (such as the Clean Seas Bottom Tension Boom) are capable of oil containment in 25 knot winds and 6-8 foot seas, in currents up to 1 1/4 knots. Recovery ability through the use of oil/water separators and oil skimmers is as much as 2,000 gallons per minute (GPM) for oil (in water) of grades ranging from light to Bunker C (heavy), in moderate seas (Clean Seas Skimmer System). Efficiency rates of skimming systems can be as much as 100 percent under ideal conditions, (Clean Seas Oil Mop, Inc. MK-II-9). Efficiency rates for containing and recovering spilled oil are greatly reduced in high wind and sea states and with high viscosity oils. When sea states and wind conditions start getting high, oil begins to get entrained above and below the oil boom, and skimmer and oil/water separator efficiencies decrease (more and more water is recovered with the oil). However, when the weather is rough, although the cleanup equipment is not as effective or may not be deployable, the natural breakup and dispersion of the oil is greatly enhanced.

Wave period will also affect recovery ability. Long, slow waves will allow for greater recoverability than waves at a higher frequency with a shorter period.

In the case of "high pour point" or very viscous oils spilling, additional efforts would be required during a spill cleanup operation. Although very viscous oils can be corralled by standard oil spill booms, it may be very difficult to recover the boomed oil by standard oil skimming devices. In addition, chemical dispersants are also less effective on high viscosity oils, as the oil/water interface is less accessible to the dispersant, the dispersant having a tendency to "roll-off" the oil. Absorbent materials (pads, straw, chicken feathers) would be necessary to soak up the oil (either within boomed off areas or open waters) and then manual labor efforts (shovels, pitchforks, etc.) would be required to remove the oil soaked sorbents from the environment. The West Coast oil spill cooperatives have this capability (see Appendix D).

When mechanical cleanup is not feasible due to weather conditions or other reasons, chemical dispersants may be applied either from the air or surface ships. Chemical dispersant technology has been advanced significantly in the last few years, reducing toxic chemical effects from the dispersants themselves while increasing dispersant efficiencies. A rigorous approval policy for dispersant use must be followed before application is allowed. A standardized chemical dispersant checklist for deciding appropriateness of usage from the Region IX Oil and Hazardous Substance Pollution Contingency Plans is included in Appendix E.

Although the use of chemical agents to facilitate oil spill cleanups is discouraged, they may be used at the discretion of the on-scene coordinator (OSC) to reduce an immediate threat to life and property. In other instances, a senior EPA official will decide whether it is appropriate to use dispersants after going through the checklist mentioned above and after consultation with the OSC and State and Federal representatives (members of the Regional Response Team - RRT). The RRT is made up of Federal and State Agencies responsible for responding to and planning courses of action in the event of environmental emergencies, such as oil spills. The EPA maintains a list of pre-approved chemical dispersants that may be considered for use.

As more research is done, the effects of chemical dispersants will be better understood. It appears now that the "last-resort" attitude towards dispersants is beginning to change. The EPA is considering streamlining the approval process, and a new policy statement is expected within the year. A multi-disciplinary task force (industry, government, academia) is currently developing ecologically based guidelines for dispersant use, with the intention of minimizing ecological damage from oil spills. Dispersants are being considered on an equal level with other cleanup alternatives, including the "no action" option. A final report is expected within the year.

It appears, at present, that the oil spill cleanup cooperatives with the assistance of the Coast Guard and the on-site oil company equipment are capable of handling the cleanup of most oil spills (less than 1,000 bbls), the chief limiting factor being weather conditions (rather than equipment) at the time of the spill. In the event of a large spill or a spill during harsh weather, dispersants may be applied, as avoidance of oil contact with shoreline or island areas is the primary concern after personal safety, adding significantly to the arsenal of oil spill countermeasures.

The California Coastal Commission is currently reviewing the oil spill response/cleanup capabilities of all the California Oil Spill Cooperatives. A final report is pending. Additionally, if Proposed Sale No. 73 proceeds as scheduled and leases are issued, a detailed oil spill contingency plan is required by MMS as part of any exploration of development plans before any drilling may proceed.

b. Cooperatives: The oil companies have pooled their resources by forming oil spill cleanup cooperatives. There are currently three such co-ops in Central and Northern California: Clean Seas in the Santa Barbara Channel and Santa Maria Basin area, Clean Bay in the San Francisco Bay, and Humboldt Bay Oil Spill Co-op in Eureka. In addition, there are five other co-ops on the West Coast, there is the Coast Guard Pacific Strike Team located in San Rafael, and there are other Coast Guard Facilities with oil spill cleanup capabilities, which would all be accessed in the event additional assistance is required (all available equipment and personnel from around the country would be made available in the event of a catastrophic spill). The co-ops are on 24-hour call and have several vessels dedicated for clean-up operations. The co-ops have the capabilities as called for by the MOU (mentioned above) to respond to an oil spill emergency within 6-12 hours with pre-staged equipment, and 48 hours with additional equipment for extraordinary spills.

The oil spill co-ops will expand their operating budgets proportionately, as increased offshore oil activity requires additional equipment and personnel to maintain an adequate level of protection and preparedness. The co-ops are constantly evaluating and purchasing new equipment, as the clean-up industry is rapidly changing. The equipment inventories for the co-ops and the Coast Guard Pacific Strike Team are included in Appendix D.

c. Contingency Plans: To implement the Clean Water Act (1973), as amended, the President's Council on Environmental Quality (CEQ) developed the National Oil and Hazardous Substances Pollution Contingency Plan. It follows specific legislative directions to include: 1) the duties and responsibilities of each Federal agency in coordination with State and local agencies; 2) a strike force of trained personnel available to provide the earliest possible alert to a discharge; 3) a system of surveillance to provide the earliest possible notice of a discharge; 4) a national center to coordinate the plan; and 5) procedures and techniques for identifying, containing, and removing the discharge or dispersing it, if necessary.

In addition, the CEQ requires a detailed oil spill contingency plan for every exploration and development plan submitted. This plan shall include emergency procedures and contact personnel, documentation of environmental areas to be protected, actual plans to follow in the event of a spill, containment and cleanup measures, and oil spill response training rquirements.

The Environmental Protection Agency and the Coast Guard are the enforcing agencies for the Clean Water Act. These agencies have the authority and the capacity to marshal the nation's capabilities to combat oil spills.

As a standard part of any OCS lease, OCS Order No. 7 requires oil spill equipment to be at the site of any drilling or development operations, and all of the requirements listed above to be met, including a detailed site specific oil spill contingency plan. As discussed earlier, the MOU effective June 1, 1982, lists guidelines for contingency plans, and is included in Appendix C.

3. Groundwater Protection: The isolation of freshwater strata from potential contaminants in a borehole is ensured by well casing, cementing, and plugging regulations set forth in the Code of Federal Regulations (30 CFR 250.41) and OCS Order Nos. 2 and 3. These regulations set forth the procedures to be undertaken during drilling and abandonment of OCS wells in order to ensure the isolation of oil, gas, and freshwater zones in the strata in which they are found, and prevent them from escaping into other strata or to the surface.

These measures should effectively maintain the purity of any freshwater aquifers which might be drilled through during OCS exploration and development activities.

The occurrence and offshore distribution of freshwater aquifers has been discussed in detail in "Oil and Gas Development in the Santa Barbara Channel Outer Continental Shelf Off California" by the USGS (1976), pages II-60 through II-70.

4. Exploration and Development Plans: The OCS Lands Act Amendments of 1978 places requirements on lessees relative to Exploration and Development Plans. This section will note particular aspects of these Plans as they relate to exploration and development activities in the Proposed Sale No. 73 area.

The holder of an OCS oil and gas lease is required to submit an exploration plan and accompanying environmental report before exploratory drilling can begin. The plan and report is submitted for approval to the Pacific region MMS office. Federal agencies (USFWS, NMFS, NPS, and USCG) and State agencies (CCC, CDFG, CARB, CDOG, CSLC) review and make recommendations to the MMS on all exploration plans. In addition, any affected local governments or any interested person may submit comments and recommendations. The CCC determines whether the proposed activities are consistent with the State's coastal zone management program.

The MMS uses the review comments of the other agencies in the preparation of an Environmental Assessment (EA). The proposed plan will be approved if the EA shows that the plan will not result in significant effects on the quality of the human environment. This approval results in a Finding of No Significant Impact (FONSI). If it is determined that approval of the plan would constitute a major Federal action (i.e., proposed oil and gas exploration functions) that would significantly affect the quality of the human environment, an EIS must be prepared. On the basis of the EA, EIS findings, and the technical review by MMS, the exploration plan will be approved, rejected, or modified.

The following sections describe the contents of the exploration plans and environmental reports.

Exploration Plan. Each exploration plan must include, but is not limited to: 1) the proposed type and sequence of exploration activities; 2) a description of drilling vessels, platforms, and other structures to be attached to the seabed, including safety and pollution prevention and control features; 3) a geophysical survey report; 4) the location of each proposed well, including surface and projected bottom hole locations; 5) an Oil Spill Contingency Plan that describes the procedures, personnel, and equipment that are to be used for preventing, reporting, and clean up of oil spills on waste material; and 6) other relevant geological and geophysical information.

Environmental Report. The ER includes, but is not limited to: 1) a detailed description of onshore support and storage facilities; 2) the estimated number of people expected to be employed; 3) boat and aircraft patterns; 4) the quantity and composition of wastes and pollutants; 5) major supplies, services, and resources needed for implementation of the plan; 6) potentially hazardous or environmentally sensitive areas, including archaeological and cultural sites; and 7) a statement of coastal zone consistency. An assessment is also made of the direct effects of plan implementation on onshore and offshore environments.

A plan is also required prior to development and production on any lease within the Pacific OCS region. As with proposed exploratory operations, an Environmental Report is necessary. The development plans and associated ER are usually much more comprehensive than those for exploration.

Minerals Management Service prepares an EA after receiving review comments and recommendations from State and Federal agencies. If State and Federal agencies jointly prepare the assessment, the resulting document is referred to as an environmental impact report/environmental assessment (EIR/EA). The State CCC also prepares a consistency determination. As with exploratory plans, MMS will either issue a FONSI or a FOSI (finding of significant impact). If a FOSI is found, an EIS must be prepared. On the basis of the EA, EIS findings, and the MMS technical review, the development/production plan will be approved, rejected, or modified.

One development and production plan, in a frontier area, is considered a major Federal action. As such, preparation of an environmental impact statement is required, including all the attendant procedures of the National Environmental Policy Act of 1969. Development and production plans in accordance with Section 19 of the OCS Lands Act as amended, must allow 60 days for comments and recommendations from the Governor and/or Executives of any affected local governments. In addition, any interested person may submit comments and recommendations.

5. Aircraft Overflight Restrictions: Aircraft are presently restricted by existing State and Federal regulations from flying at altitudes below 1,000 feet near important pinniped and seabird terrestrial habitats on the Channel Islands, Ano Nuevo and Farallon Islands. Additionally, potential lessees will be notified in the proposed notice of sale by the Instructions to Lessees to avoid flying at altitudes less than 1,200 feet above ground level near all seabird nesting and pinniped rookery areas of Southern California. Recent information from Ken Briggs at the University of Santa Cruz indicates that the 1,000 foot limit, imposed in previous sales is not sufficient for sensitive species. These increased restrictions should protect the majority of California seabirds and marine mammals from most aerial harassment.

6. Notice to Lessees and Operators: These notices have the same effect or status as OCS Orders and Regulations and are used when expeditious clarifications, corrections, or additions to the orders and regulations are necessary.

The following NTL's are now in effect:

NTL No.	Effective Date	Title
77-3	March 1, 1977	Minimum Cultural Survey Requirements OCS Exploratory Drilling
78-1	October 23, 1978	Minimum Requirements for Biological Surveys
78-2	October 23, 1978	Group Billing Procedures for Meals and Lodgings
79-1	June 22, 1979	Amends NTL 78-2
80-1	February 13, 1980	Furnishing Food, Quarters, and Transportation to USGS Personnel
80-2	March 20, 1980	Minimum Requirements for Environmental Reports
81-2	July 6, 1981	Geological Hazard Survey Requirements for OCS Exploratory Drilling
82-1	April 8, 1982	Cancels Provisions of 80-1

82-3	May 28, 1982	Minimum Requirement for Exploratory Plans on the California OCS
82-4	August 30, 1982	Interim Minimum Requirements for Marking of Equipment

The purpose of these notices is to keep lessees and operators informed as to what the MMS requires prior to approving proposals to conduct exploratory drilling operations. The text of Notices to Lessees and Operators which are currently in effect for the Pacific OCS area are on file with Minerals Management Service, Los Angeles, California.

7. Fishermen's Contingency Fund: The Fishermen's Contingency Fund of the OCS Lands Act Amendments of 1978 was established to compensate commercial fishermen for property or economic loss caused by obstructions due to oil and gas activities on the U.S. Outer Continental Shelf (OCS). Management of the Fund was given to the Secretary of Commerce and is currently administered by the National Marine Fisheries Service of NOAA. The Fund's provisions have been recently amended by PL 97-212, passed June 30, 1982 to simplify the submission of claims and reduce the time required for processing claims. Revised regulations were published in the Federal Register on November 1, 1982 (50 CFR Part 296).

The Secretary has aavailable a fund not to exceed \$2,000,000 at one time (increased from \$1,000,000) to compensate commercial fishermen for damages caused by materials, equipment, tools, containers, or other items associated with OCS oil and gas exploration, development, or production activities. (The area accounts established by the OCSLAA have been abolished except for accounting purposes.) The Fund is available to cover administrative costs, claim costs (vessel or gear damage, economic loss, and reasonable attorney's fees if the claim is accepted. Compensation for economic loss is based on 25% of the gross income the fisherman would lose by not being able to engage in fishing or having to reduce his fishing effort (rather than loss of profits). Damages are not paid to the extent that damages are due to the fisherman's negligence or fault, in excess of the replacement value of the equipment, or for any portion for which the claimant has received or will receive compensation from insurance.

Damages are presumed to be due to OCS oil and gas activities if the commercial fishing vessel was being used for fishing in an area affected by OCS activities, a report is made on the location of the item causing damages and the nature of the damages within 15 days of the vessel's return to home port (this is changed from the previous 5 days after damages discovered). There is no record of any OCS related items on the most recent nautical charts issued by the National Ocean Survey, NOAA or in any weekly Notice to Mariners issued by the Defense Mapping Agency Hydrographic/Topographic Center in effect at least 15 days prior to the damages, and there was no proper surface marker or lighted buoy near the items. However, in the case of damages caused by a pipeline, the presumption will be available regardless of whether the pipeline was recorded on charts or in the Notice to Mariners. Damage or loss occurring within a one-quarter mile radius of obstructions recorded on charts or in a Notice to Mariners, or properly marked, is presumed to involve the recorded or marked obstruction and to be due to negligence or fault of the claimant and may not be totally compensated.

All claimants (including those who filed 15-day reports to gain presumption of causation) must file a more detailed claim no later than 60 days, 39 after the date the damage or loss is discovered. The Secretary of Commerce must accept or reject a claim for consideration within 60 days of the claim being accepted for filing. If no petition to review the initial determination is filed within 30 days, the initial determination becomes the final determination. (This 90-day period compares to 120 days allowed previously and an actual average time of 22 months for claims filed to date since the claims will now be reviewed administratively by NMFS rather than by an Administrative Law Judge.) After claims are paid, the Secretary may recover payments from the party who is responsible for the damages, if a responsible party is identified. (Previously, no payments were made if damages could be attributed to a financially responsible party.) Any person who feels they have been wronged by a final determination may seek judicial review within 30 days of the final determination. The Secretary is required to submit an annual report to Congress that includes the claims received, compensation awarded, and the number of cases determined to be a result of OCS oil and gas activities.

Money used by the Fund to pay claims comes from the oil and gas industry. Lease holders, holders of an exploration permit, or an easement or right-of-way for a pipeline are assessed a fee not to exceed $5,000 per year per lease permit, easement, or right-of-way. To reduce conflicts, the Secretary must identify and classify all potential hazards to commercial fishing caused by OCS activities including all obstructions on the bottom, throughout the water column, and on the surface. (The requirement to conduct a survey of natural and manmade obstructions has been repealed.) To assist in identifying responsible parties, the Secretary of the Interior must establish regulations requiring marking of all equipment, materials, tools, containers or other items used on the OCS (refer to Notice to Lessee and Operators 82-4).

8. Fishing Vessel and Gear Damage Compensation Fund: The 1978 amendments to the Fishermen's Protection Act, established a Fishing Vessel and Gear Damage Compensation Fund. As amended, this fund is designed to compensate fishermen for: 1) fishing vessel casualties that are attributable to any foreign vessel (or its crew or fishing gear), and 2) fishing gear casualties that are attributable to any other vessel (or its crew or fishing gear), whether or not such vessel is a vessel of the United States. The Natrional Marine Fisheries Service of NOAA administers the Fund. Final regulations were published in the Federal Register on December 3, 1981 (50 CFR Part 258).

A claim for compensation must be made within 90 days after the damage was discovered by the owner. Unobserved casualties to fishing gear are presumed to be due to another vessel, its crew or its gear and, therefore, eligible for compensation unless NMFS has reason to believe the casualties were caused by other factors such as weather. The claimant must provide detailed inventory lists of owned equipment involved in the casualty for determination of repair cost or depreciated replacement cost of the damaged item, whichever is less. Economic loss is recoverable but not to exceed 25% of gross income lost because of not being able to engage in fishing activities or having to reduce fishing activity during the repair or replacement period. Compensation will be reduced to the extent that any negligence of the applicant contributed to the casualty and by the amount the applicant has, or reasonably would have received from insurance whether or not such insurance was in effect at the time

the casualty occurred. A $75 filing fee is required and a four percent administrative fee is deducted from any award made.

An initial determination of claim validity generally is made within 60 days of receipt of the claim application. If no petition to review the initial determination is filed within 30 days, the determination becomes final. Monies for the fund comes from any funds recovered from parties responsible for the damage, surcharges collected from foreign fishing vessels, administration fees and obligations issued by the Secretary of the Treasury to provide monies for the Fund.

This Fund was not established to provide compensation for fishing vessel or gear damaged by OCS oil and gas vessels, but it is available and has been used for this purpose.

9. Oil Pollution Compensation Fund: Title III of the OCS Lands Act, as amended, establishes in the U.S. Treasury an Offshore Oil Pollution Compensation fund to be administered by the Secretary of Transportation. This fund provides compensation for any person suffering direct or actual injury caused by the discharge of oil from an offshore facility or vessel. A fee of not more than 3 cents per barrel of oil produced on the OCS provides the moneys for the fund. The fees collected may be modified or increased to maintain the fund at a level between $100 and $200 million.

Claims for economic loss that arise out of, or directly resulting from, oil pollution may generally be asserted against the fund by any claimant for damages and removal costs. A U.S. claimant (who owns or leases property so damaged or who utilizes a natural resource involved) may file for injury to or destruction of real or personal property, loss of use of real or personal property, and loss of use of natural resources. The President may assess claims for injury to or destruction of natural resources over which the Federal Government exercises sovereign rights or exclusive management authority, as may a State for natural resources owned or managed by the State. Lost profits or impaired earning capacity may be claimed by a United States claimant who derives at least 25 percent of his earnings from activities using property or natural resources affected by oil pollution. Federal, State, and local governments may also assert claims for tax revenue lost due to injury to real or personal property.

Owners and operators of offshore facilities are held strictly liable for all loss attributable to oil pollution from their facilities. Except in cases of gross negligence, willful misconduct, or violation of safety regulations, vessel liability is limited to $250,000 or $3900 per gross ton, whichever is greater. For an offshore facility, liability is limited to the total clean up and removal costs, and $35 million in damages. Evidence of financial responsibility adequate to satisfy the maximum amount of liability must be provided. Congress is currently raising this amount to $75 million.

Upon payment of compensation for economic loss compensable under Title III the fund becomes subrogated to all rights, claims, and causes of action of the claimant.

C. Interrelationships of Proposal with other Projects and Proposals

1. National Parks and Sanctuaries: Under the Marine Protection, Research, and Sanctuary Act of 1972 (16 U.S.C. 1431-1434), the Secretary of Commerce with the approval of the President is empowered to designate areas as Federal marine sanctuaries for the purpose of preserving or restoring such areas for their conservation, recreation, ecological, or esthetic values, following consultation with the Secretaries of State, Defense, Interior, and Transportation, with the Administrator of EPA, and with other interested agencies. Once an area is designated a marine sanctuary, the National Oceanic and Atmospheric Administration Office of Coastal Zone Management is required to issue "necessary and reasonable regulations" for control of activities permitted within the marine sanctuary. Multiple uses (including oil and gas development) could be permitted within a marine sanctuary, providing these uses can be carried out consistent with the regulations governing the sanctuary.

The Point Reyes/Farallon Islands National Marine Sanctuary in the Bodega Basin is the only sanctuary in Central and Northern California at the present time. Oil and gas exploration and development is not allowed in this marine sanctuary.

Pipelines related to operations outside the Sanctuary may be placed at a distance greater than 2 miles from the Farallon Islands, Bolinas Lagoon, or any Area of Special Biological Significance. No person shall operate any vessel engaged in the trade of carrying cargo, including but not limited to tankers and other bulk carriers and barges, or any vessel engaged in the trade of servicing offshore installations.

Two additional sanctuaries are possible for Central and Northern California in the future. The Monterey Bay area is proposed, but the exact boundaries have not been determined. The subtidal Cordell Bank, near San Francisco, has been nominated. If the areas become sanctuaries, oil development may not be excluded within their boundaries.

In Southern California, there is the Channel Islands National Marine Sanctuary extending 6 nmi. around the northern Channel Islands in the Santa Barbara Channel. It has similar oil development restrictions to the Point Reyes/ Farallon Islands Sanctuary.

National Parks include: The Point Reyes National Seashore includes the Point Reyes peninsula (64,546 acres) which was designated in 1982 "to save and preserve, for the purposes of public recreation, benefit, and inspiration, a portion of the diminishing seashore that remains undeveloped. The Point Reyes Wilderness Area includes much of the same area and extends from the mouth of Tomales Bay to the Point Reyes Bird Observatory, consists of 24,200 acres of wilderness and 8,530 acres of potential wilderness addition (see Section III.B.10). The Outer Continental Shelf Lands Act Amendments of 1978 prohibit any exploration or development within 15 miles of the boundaries of the Point Reyes Wilderness Area unless California issues a permit for such activities in State waters.

2. California Oil and Gas Sanctuaries: The State of California has designated oil and gas sanctuaries in Central California. The Oil and Gas Sanctuaries extend to the three-mile limit of the State's jurisdiction (Figure IV.C.2-1). The Oil and Gas Sanctuaries are specifically excluded

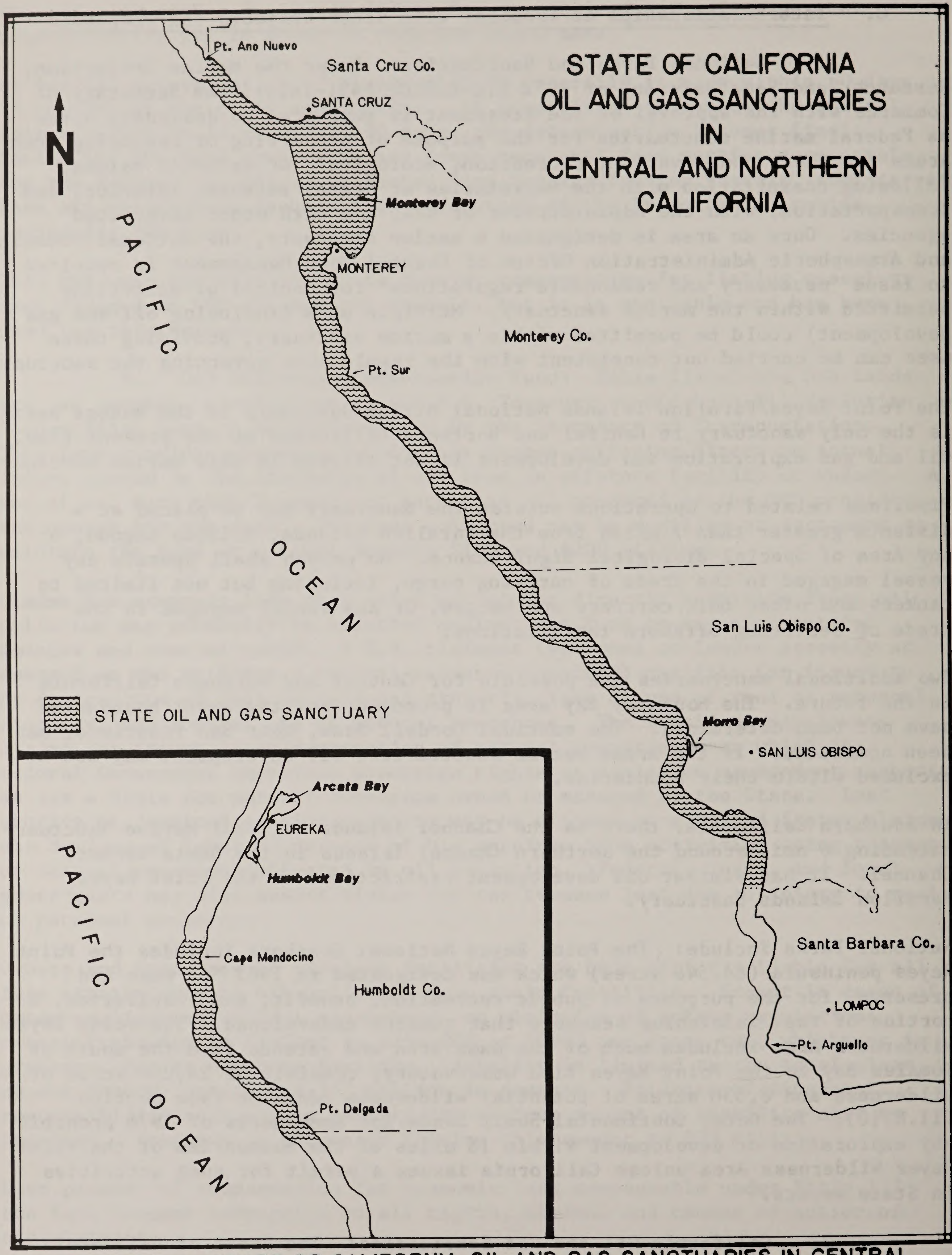


FIGURE IV.C.2-1. STATE OF CALIFORNIA OIL AND GAS SANCTUARIES IN CENTRAL AND NORTHERN CALIFORNIA

from oil and gas leasing through Chapter 1724 of the Statutes of 1955, the Cunningham-Shell Tideland Act. The Oil and Gas Sanctuaries are administered by the State Lands Commission. There is no restriction on the placement of pipelines through the sanctuaries as a result of Federal OCS activity.

3. Existing Oil and Gas Activities

a. State: Exploration and development of oil and gas has been in existence in the Pacific Region since 1896. That year, the first shallow wells beneath the ocean surface were drilled from wharfs in the old Summerland field located in the Ventura Basin. In 1929, the first State leases were issued in the offshore areas of California. After the Santa Barbara Channel Oil Spill in 1969, the State Lands Commission declared a moratorium on all new exploratory or production drilling the State waters. The majority of exploratory drilling presently being performed, are on State leases awarded in the 1950s and 1960s. Nine platforms and three production islands are presently operating on these leases. Located within the leases are areas containing subsea completions. For the approximate location of the platforms, offshore islands, and subsea completions see Figure IV.C.3-1.

The last State offshore lease sale was held in 1969. The State Lands Commission has recently been authorized by the legislature to develop the programs necessary to lease approximately 40,000 acres of State tide and submerged lands for possible oil and gas development. These lands are located offshore Santa Barbara County between Point Conception and Point Arguello and extend from the mean high tide line to the three-mile seaward limit for State jurisdiction (see Section IV.D.4).

The following offshore fields contain platforms or production islands within the three-mile limit for State jurisdiction:

<u>Conception Offshore Field</u>. The Conception Offshore Field, east-southwest of Point Conception is situated in State Leases PRC 2725 and PRC 2207. PRC 2725 was acquired by Texaco in 1961. On the lease is located an inactive Platform Herman and 19 inactive subsea completions. A Final Environmental Impact Report (FEIR) has been prepared to allow the resumption of exploratory drilling on this lease. PRC 2207 was quit claimed to Phillips, Exxon, and others in 1975. A former Platform Harry has been removed.

<u>Carpinteria Field</u>. The Carpinteria Field is situated in both Federal and State waters southeast of Santa Barbara. Within the State waters there are two Leases PRC 3150 and 4000. State Lease PRC 3150 and PRC 4000 was acquired by ARCO-Chevron in 1964 and 1966, respectively.

Platform Heidi is situated on PRC 3150 with one producing well. On PRC 4000 is situated Platform Hope with 4 producing wells.

<u>Cuarta Offshore Field</u>. A portion of the Cuarta Offshore Field, east of the Conception Offshore Field, is contained in State Lease PRC 2206. PRC 2206 was acquired by Texaco in 1958. On the lease is one inactive Platform Helen and nine idle wells. A FEIR has been prepared to allow the resumption of exploratory drilling within the lease.

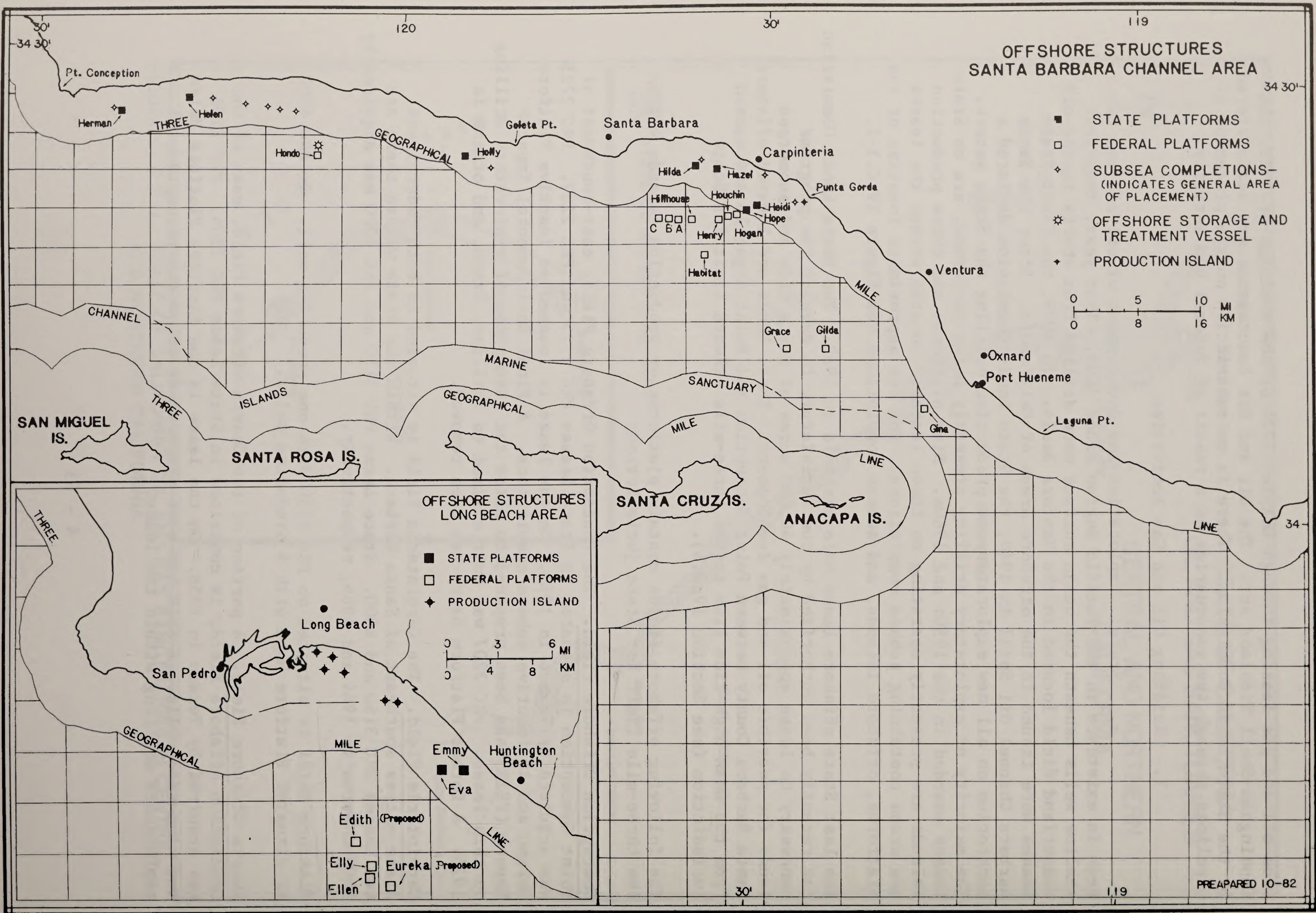


FIGURE IV.C.3-1. OFFSHORE STRUCTURES SANTA BARBARA CHANNEL AREA.

South Elwood Field. South Elwood Field, southeast of Capitan, is contained in State Leases PRC 3242 and PRC 3120. These leases, PRC 3242 and PRC 31230, were acquired by ARCO-Mobil in 1965 and 1964, respectively. Platform Holly is situated in PRC 3242 while 9 active wells are located in PRC 3120. FEIR has been prepared to allow for the resumption of exploratory drilling on both leases.

Summerland Field. Summerland Field, southeast of Santa Barbara, was the first offshore field to be drilled in 1896. The field is located in State Lease PRC 1824 and was acquired by Chevron-Exxon in 1957. Two, Platforms Heidi and Hazel, are presently producing on this lease.

Rincon. The Rincon field is located northwest of Ventura. State Lease PRC 1466 was acquired by ARCO in 1955. Located on the lease is production island Rincon.

Wilmington Field. The Wilmington Field is situated both onshore and offshore in the Long Beach area. Two State Leases PRC 186 and 2095 are located at the eastern end of the field. PRC 186 was acquired in 1945 by Exxon-Texaco. PRC 30-95 was acquired by Chevron in 1964. Located on these leases are two production islands Monterey (PRC 186) and Esther (PRC 3095).

Located west of the State Leases are State granted lands which were transferred to the City of Long Beach. On these lands are four production islands Grissom, Freeman, White, and Chaffee.

Huntington Beach Field. The Huntington Beach Field is located south of Huntington Beach. A portion of the field is contained in State Lease PRC 425 and PRC 3033. PRC 425 was acquired by Aminoil in 1950. PRC was acquired by Union in 1963. Two platforms Emmy and Eva are producing on these leases.

b. Federal: Since 1896 there have been eight Federal lease sales off the coast of California: 1963 Sale; 1966 Sale; 1968 Sale; Sale No. 35 (1975); Sale No. 48 (1979); Sale No. 53 (1980); Sale No. 68 (1982); and RS-2 (1982). For a complete discussion of the history of the lease sales refer to Section I.C in this EIS and Appendix VIII in the FEIS for Lease Sale No. 68 (BLM, 1981). Table IV.C.3-1 contains a summary of the leasing, exploration, development, and production on the POCS.

Exploration from these leases is an ongoing process. An exploration well "wildcat" is drilled primarily for the purpose of determining if oil and gas actually exists in a formation. It is only after a well has been drilled into the formation that the presence of oil and gas can definitely be confirmed or denied. Currently, there are several exploratory rigs (jack ups, submersibles, and semi-submersibles) off the Southern California and the Santa Maria Basin coast evaluating the oil and gas potentials from the previous sales. An average of 10 to 16 exploratory wells a year have been drilled since 1978.

Development wells are drilled only after an exploratory well has confirmed the presence of petroleum in the formation. The majority of the Pacific OCS oil and gas discoveries have been made on tracts which were leased in 1968 and 1975.

TABLE IV.C.4-1

CALIFORNIA PACIFIC OCS OIL AND GAS LEASING, EXPLORATION, AND DEVELOPMENT STATISTICS

SALE	LEASE NOS.	NOMINATED	SELECTED	OFFERED	BID	LEASED	TERMINATED	CURRENT	WELLS DRILLED EXPL.	WELLS DRILLED DEVELOP.	EXISTING PLATFORMS	PROPOSED PLATFORMS
1963	7-64	174	N/A	129	58	57	57	0	20	0	0	0
1966	166	N/A	N/A	1	1	1	0	1	6	94	2	0
1968	167-241	150	N/A	110	75	71	37	34	132	292	11	4
No. 35	242-311	1350	297	231	70	56	52	4	41	44	2	2
No. 48	315-369	970	217	148	55	54	3	51	23	0	0	2
No. 53	393-453	1743	242	111	81	55*	0	55	13	0	0	0
No. 68	456-490	609	218	140	35	29	0	29	0	0	0	0
RS-2	491-502	N/A	N/A	27	12	10	0	10	0	0	0	0
Total		4997	974	897	387	333	149	184	217	410	14	8

Nominated = Tracts nominated
Offered = Tracts offered for sale
Selected = Tracts selected for study in the EIS
Bid = Tracts bid
Leased = Bids accepted by BLM, USGS
Terminated = Terminated leases
Current = Leases within the 5-year term and 10-year term, and those held by production, unitization agreements, or suspension of operations
Expl. = Number of exploratory-delineation wells drilled.
Develop. = Number of development wells drilled**
Existing Platforms = Number of drilling platforms, production platforms, and treating facility (OS&T is included)
Proposed Platforms = Number of proposed platforms indicated by the submission of a development and exploration plan

*The decision on acceptance of 19 bids received from Sale No. 53 is pending results of litigation
**Includes re-drilled wells, water and gas injection (disposal and pressure wells)

Compiled by MMS February 1982

Three recent discoveries have been made between Point Conception and Point Arguello.

In November 1981, Chevron disclosed information concerning an oil strike on a tract acquired in Lease Sale No. 48. The Point Arguello discovery is located on Federal Lease OCS-P 0316 about 10 miles (16 km) west of Point Conception. No development or production plans at this time have been submitted.

In June 1982, Texaco announced the discovery of oil on Federal Lease OCS P-315. It is possible that Texaco has tapped the same structure as Chevron.

In October 1982, Chevron and Phillips announced an oil discovery on OCS P-450 located northwest of their OCS P-316 discovery tract.

There are presently seven units/fields which have current or proposed oil and gas development. Figure IV.C.3-1 shows the approximate locations of existing and proposed platforms and Offshore Storage and treatment vessel (OS&T) in the Pacific Region.

Santa Ynez. The Santa Ynez unit ranges from Point Conception to Capitan and is composed of seventeen leases acquired in the 1968 Sale. The Hondo, Sacate, Pescado, and Government Point oil fields comprise the unit. Current development is limited the Hondo Field with the installation of Platform Hondo in June 1976 by Exxon. Future development by Exxon may include three to four additional platforms but as yet no development or production plans have been submitted.

Oil from the Hondo platform is processed on an OS&T. The storage and treatment capacity of the OS&T is expected to be expanded if additional platforms are installed in the unit.

Santa Rosa Unit. The Santa Rosa Unit is located in the eastern portion of the Santa Barbara Channel. A modified plan of operation for the unit was submitted by Exxon. Three of the six leases have been relinquished and a plan was established for diligent drilling on the remaining leases. A request from Exxon for a suspension of operations was granted by Minerals Management Service for August 12, 1982 to August 12, 1983.

Carpenteria Offshore Field. The Carpenteria Offshore Field southeast of Santa Barbara is situated in both Federal and State waters. Discoveries in State waters prompted the 1966 drainage sale by the Federal Government. Two development and production plans were filed for the field's development. Phillips' plan resulted in the installation of Platforms Hogan and Houchin; and Sun's plan resulted in the installation of Platform Henry.

Pitas Point Unit. The Pitas Point Unit southeast of Santa Barbara is composed of two leases acquired in the 1968 Sale. The first discovery on the lease was an oil strike in 1968 but no development has occurred. A second discovery in 1979 was a gas strike. Texaco has recently installed Platform Habitat, and development wells are being drilled.

Santa Clara. The Santa Clara Unit southwest of Ventura comprises seven leases in the southeastern portion of the Santa Barbara Channel. The first discovery within the unit was in 1970, subsequent discoveries by Chevron have led to the planning for production platforms. Presently, there are two platforms in

the unit - Grace and Gilda. Future development by Chevron may include the installation of a third platform - Gail but no development or production plans has as yet been submitted.

Hueneme Offshore Field. The Hueneme Offshore Field southwest of Oxnard is located within two leases in the southeastern portion of the Santa Barbara Channel. And discovery led to the installation of Platform Gina by Union, for the development of the field.

Dos Cuadras Offshore Field. The Dos Cuadras Offshore Field east of Carpinteria Field was leased in the 1968 Sale. The field is located in Sun's lease OCS-P 0240 and Union's OCS-P 0241. A series of discoveries in the field led to the development and installation of four Platforms A, B, C, and Hilhouse.

D. Projects Considered in Cumulative Impact Assessment

1. Expansion of Vandenberg Air Force Base: The space shuttle and the MX programs have created the need for expansion of Vandenberg Air Force Base. Expansion of the Vandenberg facilities is expected to be completed by 1985. The space shuttle and MX programs will result in direct non-military employment at Vandenberg, increasing from 10,631 to 14,799 between 1980 and 1988.

Population is expected to increase by 12,500 for the area in the vicinity of Vandenberg. The increase in population resulting from Vandenberg expansion is expected to settle primarily in Lompoc and Santa Maria. The expected increase will peak in 1985 and level off in 1988 with the permanent net change being an increase of 8,500 people.

2. Point Conception LNG Facility: The development of this facility should result in increased vessel traffic in the vicinity of Point Conception and the Santa Barbara Channel. Construction on the LNG facility is expected to begin by mid-1983 and be concluded in 1988. Population and employment during construction of the facility should peak at approximately 9,263 and 3,865 persons, respectively. A large part of the work force used for construction of this facility is expected to come from workers that had been employed at Vandenberg AFB, resulting in a smaller net increase in population than would occur otherwise.

3. San Pedro Bay Coal Terminals: The Ports of Los Angeles and Long Beach are presently evaluating and pursuing the development of coal terminals in the San Pedro Bay. The proposed coal terminals are expected to be completed in the mid to late 1980s and handle 10 to 15 million tons of coal by 1990. The primary market for the coal passing through the San Pedro Bay harbors will be Japan. Annually, approximately 200-260 additional ships are expected to be serviced by the harbors.

4. Future Oil and Gas Exloration and Development Activity: Offshore oil and gas activities will occur as a result of previous Federal and State lease sale. This activity is summarized on Table IV.D.4-1. More detailed information on Federal and State leasing, exploration, and development activities is presented in Section IV.C.3. The proposed State Tidelands Development is discussed below.

TABLE IV.D.4-1

OIL AND GAS EXPLORATION AND DEVELOPMENT ACTIVITY WITHOUT THE PROPOSAL

Area	BBO Produced	TCFG Produced	Exploration and Delineation Well (Nos.)	Development Wells (Nos.)	Platforms (Nos.)	Artificial Islands (Nos.)	Subsea Completion Systems (Nos.)	Subsea Pipeline Systems (Nos./Miles)	Marine Terminals (Nos.)
Southern California									
Federal									
Existing[1]	0.861	1.733	204	430	13	0	0	21/110	1
Future[2]	0.221	0.114	45+	495+	15+	0	13+	*/*	*
State									
Existing	*	*	*	*	9	7	39	14/34	10
Future	*	*	*	*	*	*	*	*/*	*
Central California									
Federal									
Existing	0	0	13	0	0	0	0	0/0	0
Future	0.163[4]	0.163[4]	45	250	10	0	2	10/54	0
State									
Existing	0	0	0	0	0	0	0	0/0	7
Future	0.63	0.055	25	147[3]	6	0	1	*/*	1
Total for California	not additive	not additive	332+	1,322+	53+	7+	55+	45/198+	19+

*Unknown
[1]Activity completed as of February 1983
[2]Future activity expected as a result of existing or proposed leases (estimated)
[3]Four wells are expected to be located onshore
[4]Due to recent oil and gas discoveries there will be greater oil and gas resources and related activity than noted

The State of California has proposed oil and gas leasing in State waters, between Point Arguello and Point Conception. The proposed tideland development is expected to be both a competing and complementing activity to Federal OCS Leasing.

State leasing will compete with Federal OCS leasing in the areas of oil company revenues, manpower, facilities and other needs of the oil industry. In contrast State, leasing is a complementary activity in that much of the facilities that would be developed for servicing either State or Federal OCS activities could be shared (i.e., treatment plants, pipelines, etc.).

Estimates of the undiscovered recoverable hydrocarbon resources within the proposed Point Conception - Point Arguello lease area were calculated. There is a 95 percent likelihood that at least 63 million bbl of oil and 55 billion cubic feet of natural gas would be recoverable from the area. Exploration and development estimates for the State Tidelands lease sale is contained in Table IV.D.4-1. These estimates are based upon eight separate, hypothetical resource bearing geologic structures. Employment and population as a result of this sale is expected to increase by 575 jobs and 1,300 people. The environmental impacts associated with the State Tidelands development refer to State Lands Commission (1982).

5. Port Hueneme Expansion: Expansion of Port Hueneme would be in the form of a transfer of facilities from the Navy to the Oxnard Harbor District. The new facilities and land (wharf and 20 acres) would primarily be dedicated to offshore oil and gas activities. However, expansion would also permit additional large ships for general commodity export and import, while allowing for growth in the number of supply and crew boats servicing offshore oil and gas activity.

6. Sewage Outfalls: Approximately 300 million gallons of effluents per day are discharged from the major San Francisco Municipal Sewage Outfall into the ocean. This contributes significant amounts of sewage to the ocean but should not interfere with any action from the proposed OCS lease sale. There are no conflicts expected between the two actions and impacts are not expected to add to any measurable degree to each other due to the distance between proposed action areas.

E. Environmental Impacts of Alternative I

1. Physical Environment

a. Impact on Water Quality

i. Discussion: This section provides an estimate of the impacts on water quality from the proposed sale, i.e., the change in water quality as a result of the activities associated with the proposed sale.

The definitions employed to describe the level of impacts to water quality expected to occur as a result of OCS oil and gas activities are found in Appendix A. In the discussion of impacts which follows, the level of impact is coupled with the descriptors long term (or chronic), short term (or acute), near field (close to the source or local), and far field (away from the source or regional). The level of impact will depend upon these descriptors so that an impact may be high in the short term but low in the long term. The condition of the environment is also considered in the impact analysis such that an oil and gas related activity on the OCS in a pristine region may have a higher level of impact than the same activity occurring near major urban centers where onshore activities may have already caused water quality degradation.

Throughout oil and gas development and operation, water quality will be decreased by: 1) resuspension of sediment through exploration and development activities and pipeline construction, 2) daily sewage discharge, 3) formation water discharge, 4) drilling muds and cuttings discharge, and 5) hydrocarbon discharge through potential accidents. The impacts on water quality of each of these except the second, sewage discharges, will be discussed below. Although sewage discharges add pollutants to the ocean, the volumes expected from Proposed Sale No. 73 (see Table IV.A.8.a-1) are insignificant in relation to the volume of receiving water. Marine organisms or water quality would not experience any changes due to sewage unless immediately under the discharge pipe. Therefore, sewage is not considered to be a significant impact agent and poses no significant environmental issues as regards the proposed action.

Bottom Sediments. Bottom sediments will be put in suspension during exploration and development activities with the emplacement of reentry collars, blowout preventers, and the placement of the five drilling platforms or other sea-bottom equipment. Additionally, sediments will be suspended during pipeline placement or burial. The impacts that could result from resuspension of bottom sediments are increased turbidity and, in areas of pollutant rich sediment, the potential for pollutants to be mobilized into the water column.

The magnitude and extent to which sediment will be put into suspension will be dependent on the bottom material type and grain size, prevailing water current and the duration of the activity. For most of the activities involved in positioning, anchoring, and installing subsea equipment such as reentry collars and blowout preventers, the impact should be low short term involving turbidity increases over one or two days and within several meters to several tens of meters of the activity. Pipeline burial will likely involve much

larger volumes of sediment over periods up to weeks and, thus, have a more significant impact in increasing turbidity. These turbidity increases would have a very low impact on photosynthesis and productivity of phytoplankton except in the shallowest areas since the disturbance would be below the depth for most phytoplankton and would probably be confined to these depths by the thermal stratification which exists generally above 50 m for the California OCS area. Upwelling might be expected to bring turbid water to the surface and affect photosynthesis rates but this phenomenon is confined to the upper 200 m generally.

The movement of pollutants back into the water column from sediment particles (either by dissolving from the particles in sediments or resuspension of sediments) is expected to have very low impacts (will not elevate ambient metal or hydrocarbon concentrations) on water quality. This is because the metals are not easily dissolved from the clays and sulphide minerals to which they are intimately bound (Chen, et al., 1974). Additionally, areas of high sediment accumulations of trace metals are unknown for most of Central California. Thus, sediment resuspension would add little if any trace metals and these would be removed when sediment particles settled out again. Lower invertebrates such as benthic clams, mussels, and polychaetes have been shown to accumulate high levels of trace elements in polluted environments (Bryan and Hummerstone, 1971; Marks, 1938; Oshida, 1977).

Resuspension of sediments could also release chlorinated hydrocarbons (pesticides) and organic mercury compounds into the overlying water. The levels of these types of materials are not known for most of the Central California OCS sediments but data from the California Mussel Watch Program indicate that chlorinated hydrocarbons are introduced into the marine environment at many places along the coast (Martin, et al., 1980).

Drilling Fluids. Drilling mud (449,051 bbls) will be discharged into the ocean as described in Section IV.A.8.a. The fate and effects of drilling muds have been discussed in detail in the FEIS for OCS Lease Sale No. 53 (BLM, 1980) and Sale 68 (BLM, 1981) and further references may be consulted in the Symposium on Research in Environmental Fate and Effects of Drilling Fluids and Cuttings (Courtesy Assoc., 1980), Petrazullo (1981), and Dames and Moore (1980).

Studies to date (ECOMAR, 1978; Ray and Meek, 1980) have shown that drilling mud discharged into the ocean separates into two or three plumes, the longest of which may be up to several kilometers long. Water quality impacts decrease with increasing distance from the origin of the discharge. The limit to measurable water quality parameter changes due to muds seems to be less than 1,000 m for all parameters except light transmittance (turbidity). Turbidity increases have been measured out to more than 1,500 m (Ayers, et al., 1980) and the lightest fraction of mud (non-settleable particles) may form an upper plume visible for over 2,000 m. Water quality impacts are, therefore, considered moderate inside a radius of approximately 300 meters, low from 300 m to about 1,000 meters and very low outside 1,000 m radius around the discharge pipe during prolonged drilling and mud discharge. (See Appendix A for definition of impact levels.)

The low (slight elevations in turbidity trace metal concentrations, hydrocarbon levels, COD, etc.) and moderate level (higher conc.) impacts to water

quality are expected to disappear within a few hours after cessation of mud dumping.

Drill cuttings will be discharged along with muds as described in Section IV.A.8.a. The fate and effects of cuttings on water quality were discussed in the FEIS for OCS Lease Sale Nos. 53 and 68. The impact level on water quality of cuttings will be minimal because cuttings drop to the bottom or settle out rapidly from the discharge plume remaining in the water column only a short time. The more significant impacts from cuttings is on the benthic marine fauna and flora and are due to changes in sediment characteristics brought about by the accumulation of cuttings (see Sections IV.E.2.a to f).

Pipe lubricants and pipe joining compounds (dope) may introduce small amounts of trace metal and hydrocarbons into the ocean during routine oil and gas operations. The amounts are considered to be insignificant and pose no significant environmental issue from the proposed action.

Formation Water. Formation water (112,464 mbbls) will be discharged into the ocean once oil production begins. Discharged formation water will be dispersed (diluted) as the water mass moves away from the point of discharge but will change ambient ocean water quality near the discharge point. The main formation water characteristics affecting ocean water quality are petroleum hydrocarbons (oil), trace metals dissolved in formation water, and an absence of dissolved oxygen.

Formation water may have an impact on ocean water quality 1) when chemical constituents are raised above ocean ambient levels, and 2) when chemical concentrations of constituents are increased to a level that may have a deleterious effect on marine life. Ambient trace metal concentrations for surface ocean water off central-northern California and the highest concentration of metals in solution which are still "safe" (minimal risk) for marine aquatic life are given Table IV.E.1.a-1.

The trace metal concentrations in typical California formation water (Table IV.A.8.a-4) have been divided by 1,000 to represent 1,000-fold dilution and presented in Table IV.E.1.a-2 along with EPA 24-hour water quality criteria for comparison. The 1,000-fold dilution of formation water is what would be expected at a distance of 500 meters from the point of discharge. This estimate is based upon a numerical computer model formation water dispersion (Dickey, 1980).

Comparing the expected concentrations of trace metals in formation water after 1,000-fold dilution (500 meters from the discharge point) with EPA 24-hour criteria (Table IV.E.1.a-2) shows all metals below the EPA levels. For those substances without established EPA 24-hour criteria (arsenic, lead, silver, cyanide, and phenolic compounds), the concentrations after 1,000-fold dilution would be 2-3 orders of magnitude below the lowest levels for which effects on organisms have been demonstrated (Table IV.E.1.a-2). The data and calculations indicate all trace metals except zinc would be below the maximum concentrations that present minimal risk of deleterious effects to marine life (= maximum safe levels) (Table IV.E.1.a-1) after 1,000-fold dilution (500 meters from the discharge point).

TABLE IV.E.1.a-1

AMBIENT TRACE METAL LEVELS AND
MAXIMUM TRACE METAL LEVELS THAT PRESENT MINIMAL RISK TO MARINE AQUATIC LIFE

Concentration[a] Total Trace Metal	Central and Northern California Ocean Water	Marine Aquatic Life
	Ambient Ocean Water	Maximum[b] Concentration That Presents Minimal Risk of Deleterious Effects to Marine Aquatic Life
Trace Metal	Surface	
Cadmium	0.004-0.025 ug/l	0.2 ug/l
Chromium	No data	0.05 mg/l
Copper	0.1 ug/l	0.01 mg/l
Lead	0.005.0-0.015	0.01 mg/l
Nickel	0.200	2.01 ug/l
Silver		1.0 ug/l
Zinc	0.005-0.030	0.2 ug/l

[a]Personal communication: Dr. K. Bruland, 1979.
[b]National Academy of Sciences - National Academy of Engineering, 1972

TABLE IV.E.1.a-2

COMPARISON OF ESTIMATED MAXIMUM SEAWATER CONCENTRATIONS OF TRACE CONTAMINANTS FOLLOWING 1,000-FOLD DILUTION OF CALIFORNIA OFFSHORE PRODUCED FORMATION WATER WITH EPA WATER QUALITY CRITERIA OR LOWEST REPORTED CONCENTRATION OF EFFECT (FEDERAL REGISTER, 1980)

Trace Constituent	Estimated Maximum Conc. after 1,000-fold dilution	EPA 24-hr Criteria (ug/l)	Lowest Reported Conc. of Effect (ug/l)
Arsenic	0.08 ug/l	NE[1]	40[2]
Cadmium	0.18 ug/l	4.5	
Total Chromium	0.04 ug/l	18	
Copper	0.116 ug/l	4.0	
Lead	0.28 ug/l	NE[1]	25[3]
Mercury	0.002 ug/l	0.025	
Nickel	0.29 ug/l	7.1	
Silver	0.03 ug/l	NE[1]	2.3[4]
Zinc	3.2 ug/l	58	
Cyanide	0.004 ug/l	NE	2.0[5]
Phenolic Compounds	2.10 ug/l	NE	2560[6]

---

1 Saltwater criteria for 24-hour average not established.

2 Short-term effect, freshwater species.

3 Chronic effect, saltwater species.

4 Maximum allowable (instantaneous) saltwater concentration.

5 Projected chronic effect, saltwater species.

6 Chronic effect, freshwater species.

The impacts of formation water will probably be less than predicted by dilution factors based on Dickey's model because the model assumes no chemical reactions of trace elements in seawater. Impacts from formation waters are expected to be restricted to less than 500 meters from platforms; a radius inside of which impacts on water quality and possible impacts to biota are expected to be low (except for zinc) and outside of which impacts will be low to unmeasurable (except zinc). Impacts to the entire Proposed Sale No. 73 area considered as a unit are expected to be very low from formation water. Long-term localized and area wide impacts from formation water have not been studied on this coast but information from the Gulf of Mexico (Middleditch, 1981) leads one to expect very low impacts to water quality. (Cumulative formation water impacts are discussed in Section IV.E.1.a.)

Oil Spills. The predicted number of oil spills for the Proposed Sale No. 73 area is one spill of greater than 1,000 bbls. The fate and effects of this spill, should it occur, are subject to a variety of factors influencing the rate at which oil disappears from the environment, the populations of organisms affected, and extent of the impact on these populations. The type and quantity of spilled oil will influence the toxicity of the released hydrocarbons, crude oils being less toxic than refined petroleum products. The season during which a spill occurs will determine the degree to which water quality is degraded and the degree to which marine organisms are impacted. Winter oceanographic regimes in the lease sale area are characterized by large wind and wave energies which result in greater mixing of the surface water than occurs at other times during the year. Spills occurring during winter would, therefore, be expected to disperse more quickly and have less impact on water quality than spills during other seasons.

The most severe water quality degradation would occur during incoming tides in relatively calm waters of enclosed bays and estuaries. Severe impacts would be felt in these areas since surface slicks of oil in shallow areas would create high chemical oxygen demands relative to the volume of water underneath the slick, and organisms in these habitats would be much closer physically to the oil compared to open ocean slicks. In addition, physical processes, which would break up slicks and aid in weathering the oil, are usually reduced in estuaries, and enclosed bays. (See Section IV.E.2.g for the assessment of expected impacts to estuaries and wetlands.)

An excellent review, "Fate and Weathering of Petroleum Spills in the Marine Environment" by Jordan and Payne (1980) discusses in detail recent research into the factors affecting spilled crude oil.

A complex array of hydrocarbons and several trace metals (Table IV.E.1.a-3) are found in crude oil, some toxic and some more stable in the marine environment than others. Trace metals usually found in crude oils include nickel (Ni) and Vanadium (V) usually in the greatest concentrations but cobalt (Co), Mercury (Hg), iron (Fe), and zinc (Zn) can be abundant in crude oil as indicated for some crude oils from California (Table IV.E.1.a-3). The toxicity of nickel and vanadium was discussed in the FEIS for OCS Lease Sale No. 53. Nickel appears to be relatively nontoxic at the concentrations expected as is vanadium. However, vanadium has not been extensively investigated as to toxicity. Mercury could pose a serious threat at the levels noted in one crude oil if conditions did not permit dispersion and dilution (such as an

TABLE IV.E.1.a-3

TRACE ELEMENT CONTENTS OF 6 CRUDE OILS[a]

Elemental Conc (u g/g)[b]	RF[c]-1	RF-2	RF-3	RF-4	RF-5	RF-6
Ni	93.5	113.0	78.6	116.8	1.25	20.5
V	7.5	6.0	4.9	112.0	26.0	8.2
Co	12.7	13.9	14.5	0.198	0.001	0.0354
Hg	21.2	1.49	1.46	0.139	0.0143	0.0898
Fe	73.1	77.2	89.5	36.9	5.0	4.94
Zn	9.32	19.50	19.60	2.619	0.0907	9.08
Cr	0.634	0.685	0.729	0.380	0.1	0.081
Mn	2.54	3.10	2.96	0.21	1.50	0.79
As	0.656	1.63	0.67	1.20	0.2	0.0773
Au	$2.8x10^{-6}$			$3.0x10^{-6}$	10^{-7}	$6.4x10^{-5}$
Sb	0.0517	0.061	0.11	0.273	10^{-3}	0.055
Se	0.364	0.454	0.333	0.360	0.009	0.128
Sc	$8.8x10^{-3}$	$9.0x10^{-3}$	$4.6x10^{-3}$	$4.4x10^{-3}$	$9.5x10^{-5}$	10^{-5}
Cu	0.93	1.25	1.13	0.21	0.2	0.10
Na	11.1	65.2	15.5	25.0	1.0	13.0
Ca	192.0	75.1	103.0	150.0	20.0	20.0

[a]Oils RF-1, 2, 3 from California; RF-4, Venezuela, Louisiana and RF-6, Libya

[b]Conc = concentrations in ppm

From Filby and Shah (1971)

[c] = RF = reference oil

estuary trapped spill). It is impossible to predict, however, which if any crude oils with high mercury values might be found in the Proposed Sale No. 73 area.

The hydrocarbons in crude oil are a complex mixture of thousands of types of simple carbon chains and complex branched and ring carbon structures. The persistence of various classes of compounds in the marine environment differs as discussed by Jordan and Payne (1980) and, therefore, water quality will experience impacts from varying groupings of hydrocarbons with the increasing age of a spill or distance from a spill location. The level of impact to water quality from spills is based on the estimated resources in each of the basins and projections from historical spill data trend analysis.

PROPOSED SALE AREA

Approximately 500,000 cu. yds. of sediments would be moved during pipeline placement. Impacts to water quality from temporary localized turbidity increases would be very low and impacts due to mobilization of trace metals or chlorinated hydrocarbons would also be very low (probably not measurable). Sediments in the basin are not suspected to be high in either trace metals or hydrocarbons.

Approximately 250,000 barrels of cuttings and 112,000 barrels of muds are expected to be discharged into the southern portion of the Santa Maria Basin. The level of impact to water quality from this material is expected to be low (increases of 2-3 times ambient suspended particulates and trace metals lasting only a few hours) at distances greater than 1,000 meters from the discharge point. Impacts would be moderate (increases 2-3 orders of magnitude above ambient) within 300 meters of the discharge point. These levels are expected if the expected five platforms are scattered in the southern portion of the Santa Maria Basin. Should the five platforms be grouped on adjacent lease tracts the level of impact to water quality would be greater (moderate level impact over a much wider area) than described above. However, the grouping of platforms near each other is not expected.

Approximately 100,000 barrels of formation water would be discharged per day in the Santa Maria Basin during the peak production year with an average of 62,000 barrels per day for the expected 20-year life of the field. This discharge is expected form five platforms or an average of 20,000 barrels per day at peak production and averaging 12,000 barrels per day during the life of the field for each platform. The level of impact is expected to be low to very low outside a radius of 100 m from the discharge points. The exceptions to low or very low levels of impacts could occur should platforms be placed on adjacent tracts. In this case, formation water discharges could be additive from one platform to another leading to a zone of low to moderate impact on water quality over an extent of several lease tracts.

One oil spill greater than 1,000 barrels is expected in the proposed sale area as a result of the proposed action. The impact to water quality from the expected spill is expected to be moderate (increase in water column trace metals and hydrocarbons by factor of 2-3 orders of magnitude over ambient levels persisting for several days to a week depending on weather conditions, sea state, distance below or away from oil slick). This moderate level of impact could apply to the entire sale area if the spill occurs in the northern

portion and is moved south through the area by winds and currents. It is impossible to predict this potential impact with any degree of accuracy; however, historical wind and current data indicate this movement is possible if a spill should occur.

AREAS OUTSIDE THE SALE AREA

No pipelines or platforms are expected in any area outside the sale area from the proposed sale. Therefore, no sediment resuspension is expected in any area outside the sale area from oil and gas activities associated with the proposed sale.

No muds or cuttings are expected to be discharged in any area outside the sale area from OCS oil and gas activities associated with this sale. Muds and cuttings discharged within the sale area are not expected to cause impacts in any area outside the sale area. The possible exception is muds and cuttings discharged within 1,000 m of the northern or southern limits of the sale leading to very local impacts up to 1,000 m outside the sale area. However this latter is not expected.

No formation water is expected to be discharged in any area outside the sale area from oil and gas activities associated with this sale. Formation water discharged within the sale area could affect water quality in the immediate (within 3 miles) areas to the north or south of the sale area if formation water discharges should occur within 5-10 km of these sale area borders. This latter case is expected in the southern portion of the sale area where formation water from production may move into the area south of Point Conception. The concentration of formation water (and associated trace metals and hydrocarbons) is expected to be very low in any area outside the sale area.

Accidental discharges of crude oil associated with the proposed action are not expected in areas outside the sale area with the minor exception of a very small probability of spills due to tankering occurring outside the sale area. No oil spills greater than 1,000 barrels are expected in the Bodega and Santa Cruz Basins as a result of tankering. The impacts from accidentally discharged petroleum hydrocarbons is therefore expected to be very low. If a spill did occur the impact to water quality would be moderate (2-3 orders of magnitude increase in hydrocarbons above ambient) for a period of days to one or two weeks. Oil spilled within the sale area could affect water quality outside the sale area. (See Section IV.A.4.) Accidental discharges of oil in the northern portion of the proposed sale area could degrade water quality in the northern portion of the Santa Maria Basin and spills in the southern portion of the sale area could degrade water quality of the ocean off southern California. The extent of water quality degradation in either area outside the proposed sale area is unknown but would depend on variable currents, winds, and the amount of oil spilled.

ii. Conclusions: Water quality in the immediate vicinity of oil exploration and development activities would be degraded. The degree of impact (degradation) to water quality would be very low to low (see definitions of impact levels in Appendix A) from routine discharge. Impacts to water quality are expected to be moderate in the southern Santa Maria Basin from the one expected oil spill. The short-term effects of OCS activities in the marine

environment, except immediately around platforms, should not result in any greater than very low levels of change in water quality parameters (trace metals, hydrocarbons, salinity, temperature, turbidity, pH, etc.).

iii. Cumulative Impacts: The cumulative impact from existing and proposed OCS activities should not violate EPA regulations, OCS Orders, or State of California Ocean Plan guidelines in the general California OCS Region. Water quality would remain good and would not exceed concentration levels set by their limits. The exceptions to high water quality would be within several hundred meters of oil and gas activities (platforms) where discharges of drilling muds and cuttings and formation water are expected to produce very low to low water quality impacts. Oil spills from proposed and existing OCS activities may also produce exceptions to high water quality with moderate level impacts. Similar exceptions to good water quality may be expected in nearshore waters around municipal sewage discharges. The exceptions to good water quality mentioned above from cumulative sources are expected on a localized near platform scale and not over the entire sale area.

Thermal discharges (heated water) associated with conventional (fossil fuel) and nuclear power plants will raise ambient water temperatures in coastal water around these plants. It is not expected that these discharges will combine with thermal discharges used to cool generators on oil and gas platforms to produce any cumulative effects on water quality. Cumulative thermal discharges should not be significant to water quality in the general California OCS Region.

Oil and gas activities in the southern portion of the Santa Maria Basin may result in discharges from platforms combining with agricultural runoff from dairy land and produce a cumulative impact in the Morro Bay area. Nearshore current data is sparse for this region and the potential for the cumulative impact is only indicated by a few surface current drifter studies (Williams, et al., 1981). It is expected that the cumulative impacts from these sources will be very low with the majority of nearshore pollutants coming from agricultural runoff.

An unknown number of oil spills is expected to occur from development of oil and gas resources in State of California Tidelands and other vessel traffic. This would add to Proposed Sale No. 73 impacts in the southern part of the sale area.

b. Impact on Ocean Dumping

i. Discussion: Ocean dumping is the disposal of waste material in areas of the ocean which the Environmental Protection Agency (EPA) has designated as suitable for the various types of waste materials. These waste materials have consisted of substances such as low level radioactive waste, obsolete munitions, industrial waste, toxic chemicals, and dredge spoils.

Low level radioactive waste has not been disposed at sea since 1970 (Brown 1971, EPA 1980) when disposal by shallow land burial became the accepted means of disposal. The U.S. Navy, however, discharges low level waste from operations of nuclear vessels at sea (NAS 1971) in accordance with specific Nuclear

TABLE IV.E.1.b-1

RANGE OF PLUTONIUM CONCENTRATION FOUND IN MARINE ORGANISMS

Organism		No. of Samples	Range of Concentration Factors
Algae		29	100 - 3,500
Sargassum (attached)		2	325 - 450
Plankton (mixed)		2	
Sponge		1	2,100
Annelid Worm		1	4,100
Starfish		1	1,020
Gastropod	(Body)	2	140 - 660
	(Shell)	2	300 - 690
Bivalus	(Body)	7	230 - 520
	(Shell)	2	490 - 600
Fish		29	1 - 1,100

Source: from NAS 1975

Regulatory Commission requirements (10 CFR 20.302). The Navy at sea discharges are not solid waste and are, therefore, not subject to impact from the proposal.

Since bottom disturbing activities are the major impact producing agents to dump sites, a potential for disturbance of toxic and other waste material exists on the OCS. Dump sites are subject to impact from offshore development only if they are directly contacted. This contact could be from the actual placement of a platform, subsea completion, or pipeline, or could occur from the anchoring or drilling associated with exploration. The impact incurred would depend upon the type of material composing the dump site. However, this is considered unlikely since water depths for the Santa Maria Basin dump site exceed 2,000 fathoms. (See Appendix A for a listing of the levels of impacts to ocean dumping and their definition).

Low level radioactive waste is comprised of tools, gloves, transport containers, and other articles which have been contaminated. The contaminated material was usually placed in 200 liter (55 gallon) oil drums and completely surrounded with concrete (NAS, 1971). These drums were then dumped into the ocean at the designated sites. The integrity of these containers is not always assured as they have been known to rupture due to the pressure. Of the 59,000 containers dumped at the Farallon Islands between 1966 and 1969, it was estimated that in 1977 as many as 25 percent of the containers may be leaking (Lipshutz, 1981). If a dump site is impacted by OCS activities it could result in an increase of the release of the radionuclides into the marine environment. Low level waste contains on the average less than one curie of activities per cubic foot of material, which allows for "hot spots" where the contamination may be many times the average level (Lipshutz, 1980).

Upon release to the marine environment, the radioactivity can progress up through the food chain with the associated bioaccumulation of the radiation. (See Table IV.E.1.b-1.) Strontium-90 has been seen in concentrations as high as 65,000 in clam shells, and cesium-137 concentrations in ducks as high as 2,500 times that of their food (Lipshutz, 1980).

Obsolete munitions could cause impact if contacted due to the potential instability of the munitions. Industrial wastes and toxic chemicals could be dispersed through the water column and over the immediate surrounding areas, but would be diluted and become less hazardous with distance from the disturbance.

Dredge spoils if disturbed would have an impact on benthic life in the immediate area of disturbance, and would be similar (possibly more severe) to that observed from drill cuttings. Impacts of drilling muds and cuttings are discussed in Section IV.A.8.

If a dump site is contacted, the potential impact could range from very low (boundary lines might overlap but operations will not disturb any existing dump sites, or operations will have no conflicts with use of the area as a dump site) to very high (operations would disturb an existing dump site resulting in contamination of the water column over a large area, or operations would prohibit use of the area as a dump site) depending upon the material in the dump site.

PROPOSED SALE AREA

There are three designated dumping areas in the Proposed Sale No. 73. One is a low level radioactive waste and military dumping area. The site covers 1,125 square nautical miles and conflicts with all or part of tracts 46-51, 67-72, 87-93, 107-114, 128-135, 148-156, 168-176, 188-196, 213-215. These areas are located in 2,000 fathoms of water or greater. The amount of low level radioactive waste material dumped at this site is unknown, thus, it must be assumed that any bottom disturbing activity in this area will have a very high impact.

OCS Order No. 2 requires a hazards report and other surveys as necessary for safe exploration and development activities on the OCS. A bottom survey of the area in which the dump sites are located should be run prior to the actual exploration or development activities. This survey should be capable of detecting the waste containers, and will enable the operator to ascertain that none of the waste material will be disturbed by the development of the area. This will reduce the potential very high impact to very low.

The other two dump sites were used only once for dredge spoil material from Morro Bay and as such no impact is anticipated even if they are disturbed.

Five platforms, 155 wells and 114 miles of pipeline are anticipated from the sale. The probability of one or more of these disturbances contacting the dumping area is low. If the dumping area is not contacted, a very low impact is anticipated to dump sites in the Santa Maria Basin.

AREAS OUTSIDE THE PROPOSED SALE AREA

No impact is expected to dump sites in the Northern portion of the Santa Maria Basin, or in the Southern California Bight as a result of this proposal. This is due to the fact that no bottom disturbing activities would occur in either of these areas as a result of the proposal.

ii. Conclusion. The expected impacts to dump sites would be very low (boundary lines might overlap but operations will not disturb any existing dump sites, or operations will have no conflicts with use of area as a dump site).

iii. Cumulative Impacts: Impacts to ocean dumping in the region will occur from other projects and existing leases. The expansion at Vandenberg Air Force Base will have a need for an offshore dredge spoil site. The State Tidelands would not impact any sites as no designated sites are in the planning area between Pt. Arguello and Pt. Conception. The existing leases in southern Santa Maria Basin are expected to have a very low impact to the dump sites in the area.

The proposal does not significantly add to the impacts from these sources unless the low level radioactive waste site off Pt. Arguello is contacted.

c. Air Quality

i. Discussion: Effects of Proposed Sale No. 73 activities on air quality have been estimated through computer simulated models. Calculated air quality levels represent only a reasonable approximation based on probable exploration and development plans, production schedules, and transportation scenarios. Site specific information will not be available until development actually takes place. Prior to any company constructing a source resulting in significant pollutant emissions on the OCS, Minerals Management Service (MMS) will perform a detailed air quality analysis and will determine anticipated air quality impacts including cumulative effects from interaction with existing OCS pollution sources (see Section III.A.9).

Inert pollutants were modeled using EPA-approved Gaussian diffusion models. Ozone concentrations were calculated using the RAPT (Reactive Air Pollutant Transport) model. RAPT is a model which calculates concentrations of photochemically reactive pollutants along a trajectory determined by the wind flow.

Gaussian models can estimate concentrations within a factor of two (the ratio of calculated to actual concentration ranges between 0.5 and 2) when emissions and meteorological impacts are known with high precision. In general practice, results are much poorer and can be in error by a factor of 10.

The accuracy of the RAPT model is more difficult to evaluate due to the complexity of the many variables involved. The state-of-the-art of photochemical modeling is being updated constantly. Accuracy is limited by imperfect knowledge of the very complex chemistry of reactive pollutants in the atmosphere. However, if the model is carefully applied, it is possible to achieve an accuracy within a factor of two.

Minerals Management Service has conducted tracer studies at several locations along the California coast to characterize overwater dispersion characteristics. One study was conducted near Ventura (AeroVironment, 1981), and another study was performed near Santa Maria. Results from the latter study will be available in 1983. The study results will be used to improve the accuracy of air quality models used by MMS in OCS impact assessments.

Assumptions were used in the modeling so that calculated concentrations were generally overestimated. A detailed discussion of the methodology and all technical assumptions is presented by Form & Substance, Inc. (1983).

The most significant assumptions used in the analysis are summarized below:

- For short-term concentrations, emissions were maximized by assuming simultaneous operation of all possible emission sources.

- Mobile emission sources were treated as originating from a point, rather than being spread along a line.

- Adverse meteorological conditions including light wind speeds (2 meters per second), direct pollutant transport to shore, and stable atmospheric conditions for short-term average calculations.

- Absorption of NO_x and SO_x by the ocean or land surface was ignored.

All NO_x concentrations were assumed to be in the form of NO_2.

- Stability of parameters were modified to account for overwater dispersion using results from offshore tracer studies (AeroVironment, 1981).

PROPOSED SALE AREA

Modeling Results

Maximum calculated onshore concentrations of inert pollutant associated with Proposed OCS Sale No. 73 are presented in Tables IV.E.1.c-1 and IV.E.1.c-2. Inert pollutants were modeled for the exploratory, development, and production phase. Ozone was modeled for the production phase only since impacts due to ozone would be highest during this phase. The concentrations are compared with the Department of Interior (DOI) Significance Levels as well as Federal and State Ambient Air Quality Standards (AAQS).

Exploratory Phase. Maximum 1-hour average concentrrations from exploratory drilling activities for NO_x, $SO_,$ and CO, would be 211, 13, and 38 ug/m^2, respectively and would occur in San Luis Obispo County (Table IV.E.1.c-1). Pollution levels for Santa Barbara County would be slightly lower because exploratory activities would take place at a somewhat larger distance from shore. The California AAQS for 1-hour average NO_2 levels is 470 ug/m^3. The maximum observed 1-hour average NO_2 concentration at Morro Bay was 206 ug/m^3. If the calculated NO_x levels was added to observed concentrations, the total pollutant level would still be below the California AAQS.

Maximum concentrations of SO_2, CO, and TSP would be well below the DOI Significance Levels. The maximum 3-hour SO_2 concentration is 52 percent of the DOI Significance Level; the maximum 8-hour CO concentration is only 8 percent of the DOI Significance Level. Maximum 24-hour TSP concentrations were not calculated, but they would be expected to be smaller than those for the development phase.

Annual average concentrations were also not calculated. However, concentrations would be much lower than for the development phase, and would thus be well below the DOI Significance Levels.

Development Phase. Maximum short-term concentrations would occur during platform installation. The modeling results are given in Table IV.E.1.c-1. The greatest impact would occur in San Luis Obispo County, and the primary impacting agent would be NO_x. The mamimum 1-hour average concentrations for NO_x, SO_2, and CO, would be 202, 14, and 40 ug/m^3, respectively. If the calculated NO_x levels were added to observed concentrations, the total pollutant level would be below the California AAQS.

Maximum calculated concentrations of SO_2, CO, and TSP would be well below the DOI Significance Levels. The maximum 3-hour SO_2 concentration would be 56 percent of the DOI Significance Level. The maximum 24-hour TSP level would be 40 percent of the DOI Significance Level. The maximum 8-hour CO concentration would be only 8 percent of the DOI

Table IV.E.1.c-1

Maximum Predicted Onshore Short-Term Pollutant Concentrations, Proposed OCS Sale No. 73 [1,2]

	Pollutant Concentration (ug/m3)						
	NO_x	SO_2			CO		TSP
Averaging time	1-hr	1-hr	3-hr	24-hr	1-hr	8-hr	24-hr
Exploratory Phase							
San Luis Obispo County	211	13	13	N/A[3]	38	38	N/A[3]
Santa Barbara County	172	10	10	N/A	31	31	N/A
Development Phase[4]							
San Luis Obispo County	202	14	14	2	40	40	2
Santa Barbara County	115	8	8	1	22	22	1
DOI Significance Level	-	-	25	5	2,000	500	5
Federal AAQS	-	-	1300	365	40,000	10,000	260
California AAQS	470	1310	-	131	23,000	10,000	100
Maximum Observed Air Quality Level[5]							
San Luis Obispo County	206	209	N/A[6]	63	11,429	7,500	102
Santa Barbara County	75	104	N/A	31	17,142	9,900	121

1. Based on air quality analysis by Form and Substance (1983 a,b)

2. Calculations made for the expolratory and development phases only. For the production phase, concentrations could be lower than for the development phase

3. No modeling was performed for these averaging periods. Concentrations were judged to be lower than those for similar averaging periods for the development phase.

4. Concentrations are for the peak development year (1989)

5. Maximum observed air quality levels were obtained from the monitoring station nearest the location of maximum calculated concentrations. Monotoring data obtained from CARB and are for the year 1981.

6. N/A indicates monitoring data for this averaging period were not available.

Table IV.E.1.c-2

Maximum Predicted Onshore Annual Average Pollutant concentrations, Proposed OCS Sale No. 73[1,2]

	Pollutant Concentration (ug/m^3)			
	NO_2	SO_2	CO	TSP
Development Phase[3]				
San Luis Obispo County	0.35	0.01	0.19	0.02
Santa Barbara County	0.86	0.05	0.49	0.05
Production Phase[4]				
San Luis Obispo County	0.38	Neg.[5]	0.21	0.01
Santa Barbara County	0.13	Neg.	0.08	0.01
DOI Significance Level	1	1	-	1
Federal AAQS	100	80	-	60
California AAQS	-	-	-	60
Maximum Observed Air Quality Levels[6]				
San Luis County	43	16	N/A[7]	58
Santa Barbara County	28	16	N/A	63

—

1. Based on air quality analysis by Form and Substance (1983 a,b)
2. Calculations made for the development and production phases only. For the exploratory phase, concentrations would be lower than for the development phase.
3. Concentrations are for the peak development year (1989).
4. Concentrations are for the peak production year (1993).
5. Negligible indicates concentrations less than 0.01 ug/m^3.
6. Maximum observed air quality levels were obtained from monitoring station nearest the location of maximum calculated concentrations. Monitoring data obtained from CARB and are for the year 1981.
7. N/A indicates monitoring data for this averaging period were not available.

Significance Level. Predicted concentrations of SO_2 and CO added to existing background levels, would be below Federal and State AAQS. However, existing TSP concentrations exceed the State AAQS. Concentrations from Proposed Sale No. 73 activities would be only 2 percent of existing TSP concentrations. Mamimum calculated annual average pollutant concentrations for the development phase are given in Table IV.E.3.c-2. The maximum NO_2 concentration of 0.86 ug/m^3 for Santa Barbara County is close to the DOI Significance Level of 1 ug/m^3. Concentrations are well below the DOI Significance Levels for all other pollutants. Proposed OCS Sale No. 73 developments would not add significantly to existing pollution concentrations. Existing TSP levels in Santa Barbara County exceed the State and Federal AAQS. However, OCS emissions would be less than 0.1 percent of existing concentrations.

Production Phase. Maximum short-term concentrations were not calculated for the production phase. However, concentrations are expected to be lower than during the development phase. During the production phase, emissions would be more constant with time and high short-term emission rates associated with with development would not occur. The level of impacts would therefore be smaller.

Maximum annual average pollutant concentrations for the production phase are given in Table IV.E.1.c-2. Greatest effect would be on San Luis Obispo County. The greatest impact would be from NO_x. The maximum annual average NO_x concentration would be 0.38 ug/m^3. This is still well below the DOI Significance Level. Concentrations for all other pollutants would be very small.

Tankering activities at Gaviota would cause maximum annual average concentrations of NO_2, SO_2, and TSP of 1.15, 0.08, and 0.09 ug/m^3, respectively. The NO_2 concentration is only 1 percent of the Federal AAQS. The pollutant concentrations would not contribute significantly to existing levels.

Trajectory modeling to calculate impacts from ozone (O_3) was performed by first establishing a baseline level (without Proposed Sale No. 73 sources). Estimated future onshore emissions were obtained from local Air Pollution Control Districts. The model was run using these data to establish the future baseline level. The same trajectory was then run including emmissions from Proposed Sale No. 73 developments. The ozone impact was then determined by calculating the difference in ozone levels for the two model runs at each point along the trajectory. The trajectories used in this analysis passed over more than one OCS facility, to maximize impacts.

Modeling was performed with trajectory endpoints at Nipomo, Santa Ynez and Goleta. The results are shown in Table IV.E.1.c-3. The maximum ozone increments were 1 to 2 pphm. The Federal and State AAQS for ozone are 12 and 10 pphm, respectively. Since future baseline levels already exceed the State AAQS and almost exceed the Federal AAQS, the Proposed Sale No. 73 sources could lead to violations of the standards. However, it must be noted that the models were run assuming very restrictive meteorological conditions. These conditions are expected to prevail only 2 or 3 days per year. Monitoring data for Nipomo shows that ozone

Significance Level. Predicted concentrations of SO_2 and CO added to existing background levels, would be below Federal and State AAQS. However, existing TSP concentrations exceed the State AAQS. Concentrations from Proposed Sale No. 73 activities would be only 2 percent of existing TSP concentrations. Mamimum calculated annual average pollutant concentrations for the development phase are given in Table IV.E.1.c-2. The maximum NO_2 concentration of 0.86 ug/m^3 for Santa Barbara County is close to the DOI Significance Level of 1 ug/m^3. Concentrations are well below the DOI Significance Levels for all other pollutants. Proposed OCS Sale No. 73 developments would not add significantly to existing pollution concentrations. Existing TSP levels in Santa Barbara County exceed the State and Federal AAQS. However, OCS emissions would be less than 0.1 percent of existing concentrations.

Production Phase. Maximum short-term concentrations were not calculated for the production phase. However, concentrations are expected to be lower than during the development phase. During the production phase, emissions would be more constant with time and high short-term emission rates associated with with development would not occur. The level of impacts would therefore be smaller.

Maximum annual average pollutant concentrations for the production phase are given in Table IV.E.1.c-2. Greatest effect would be on San Luis Obispo County. The greatest impact would be from NO_x. The maximum annual average NO_x concentration would be 0.38 ug/m^3. This is still well below the DOI Significance Level. Concentrations for all other pollutants would be very small.

Tankering activities at Gaviota would cause maximum annual average concentrations of NO_2, SO_2, and TSP of 1.15, 0.08, and 0.09 ug/m^3, respectively. The NO_2 concentration is only 1 percent of the Federal AAQS. The pollutant concentrations would not contribute significantly to existing levels.

Trajectory modeling to calculate impacts from ozone (O_3) was performed by first establishing a baseline level (without Proposed Sale No. 73 sources). Estimated future onshore emissions were obtained from local Air Pollution Control Districts. The model was run using these data to establish the future baseline level. The same trajectory was then run including emmissions from Proposed Sale No. 73 developments. The ozone impact was then determined by calculating the difference in ozone levels for the two model runs at each point along the trajectory. The trajectories used in this analysis passed over more than one OCS facility, to maximize impacts.

Modeling was performed with trajectory endpoints at Nipomo, Santa Ynez and Goleta. The results are shown in Table IV.E.1.c-3. The maximum ozone increments were 1 to 2 pphm. The Federal and State AAQS for ozone are 12 and 10 pphm, respectively. Since future baseline levels already exceed the State AAQS and almost exceed the Federal AAQS, the Proposed Sale No. 73 sources could lead to violations of the standards. However, it must be noted that the models were run assuming very restrictive meteorological conditions. These conditions are expected to prevail only 2 or 3 days per year. Monitoring data for Nipomo shows that ozone

Table IV.E.1.c-3

MAXIMUM ONSHORE OZONE CONCENTRATIONS FROM PROPOSED OCS SALE NO. 73[1]

Trajectory	Ozone Baseline (pphm) at the Trajectory End Point		Ozone Concentrations at the Trajectory End	Maximum Incremental Onshore shore Ozone Impact
	Present	Future	(pphm)	(pphm)
Nipomo	11	12	14	2
Santa Ynez	11	10	11	1
Goleta	4	4	6	2
Goleta (cumulative)	4	4	9	5

1. Based on ozone Modeling performed by Form and Substance (1983 b).

levels close to the State AAQS occur only several times a year.

Proposed Sale No. 73 activities therefore have the potential of causing moderate impacts to the Santa Barbara County Nonattainment Area (significent increase in pollutant concentrations within a nonattainment area expected to occur about 2 or 3 days per year). Since the modeling results show an increase in O_3 concentrations in a nonattainment area, MMS would, under the DOI air quality reguations, require emission controls to prevent adverse impacts (47 FR 16358). This measure would effectively prevent significant O_3 concentrations. However, a determination of the specific emission controls to be required would not be made until an application to construct has been reviewed by MMS and more site-specific modeling studies have been performed.

Visibility.

Calculations were also made to assess potential effects on atmospheric visibility. Atmospheric visibility was defined in terms of visual range (the farthest distance at which a black object can be perceived against the horizon). The model assumed light wind speeds, stable atmospheric conditions, and a background visual range of 15 km (9.4 miles). The maximum reduction in visual range varied from 1.5 to 3.3 percent (Form and Substance, 1983). This would not be a noticeable reduction in visibility, therefore no significant impact on visibility would be expected.

AREAS OUTSIDE THE PROPOSED SALE AREA

Projected increments for inert pollutants for the coastal areas adjacent to the Santa Barbara Channel would be smaller than those calculated for the Santa Maria Basin and would be well below DOI Significance Levels.

Ozone calculations were made along a trajectory starting over OCS waters off Point Conception, passing throught the Santa Maria Channel, and terminating at Goleta. The maximum increase in ozone was 2 pphm. The baseline level at Goleta was quite low (only 4 pphm). Goleta normally experiences violations of the Federal AAQS several times a year. However, meteorological conditions that would be associated with transport of pollutants from the Santa Maria Basin involves a long trajectory almost entirely over water, and under these conditions background ozone levels would be very small. Proposed Sale No. 73 activities would therefore cause no significant impacts to ozone levels in the Santa Barbara Channel area. Overall impacts for the area would be low (insignificant increase in air quality concentrations within a nonattainment area).

Air quality may be affected at the refineries in the San Francisco Bay Area and in the Los Angeles Basin because offshore oil tends to have a higher sulfur content than oil being refined presently. This may result in an increase in concentrations of sulfur dioxide and total sulfates. Local air pollution control agencies may require additional pollution control equipment or modification of the processing facilities. The magnitude of air quality impacts cannot be determined presently.

ii. Conclusion: Moderate air quality impacts were predicted for the coastal regions within the Santa Barbara County nonattainment area (significant increase in pollutant concentrations within a nonattainment area expected to occur about 2 or 3 days per year). It is likely, therefore, that OCS facilities associated with Proposed Lease Sale No. 73 would be required under DOI air quality regulations to apply emission controls. Application of emission controls would reduce the predicted impacts to low. Significant increases in short-term NO_2 concentrations were also predicted, but concentrations would most likely be below State ambient air quality standards.

iii. Cumulative Impacts Inert Pollutants. Air quality modeling was performed to estimate the combined impacts form Proposed Sale No. 73 and Sale No. 53 anticipated activities. Short-term average pollution concentrations would not change significantly from those attributed to Proposed Sale No. 73 alone This is because under meteological conditions leading to highest concentrations, plumes from individual sources are very narrowly defined, thereby causing little interaction among multiple sources. Also, Sale No. 53 facilities are expected to be in production by the time construction activities for Proposed Sale No. 73 commences.

On an annual basis, maximum cumulative impacts would occur in Santa Barbara County, and would be realized in the peak development year (1989). The maximum annual concentration for NO_2, SO_2, and TSP would be 0.98, 0.05, and 0.05 ug/m^3, respectively. The NO_2 concentration would be very close to the DOI Significance Level of 1 ug/m^3. Concentrations for SO_2 and TSP would be very small. If these concentrations are added to currently measured concentrations, the resulting levels would be below Federal and State AAQS, except for TSP. However, OCS emissions would contribute less than 1 percent of combined TSP concentrations.

Ozone. Increments in ozone levels from cumulative effects would range from 1 pphm at Santa Ynez to 5 pphm at Goleta. Impact levels would be about the same as for the Proposed Sale No. 73 alone. These impacts would be described as moderate (significant increase in pollutant concentrations in a nonattainment area expected to occur 2 or 3 days per year). The area primarily effected would be the western portion of Santa Barbara County. Although the model shows a significant increase in O_3 levels at Goleta, cumulative impacts from OCS developments would not cause any violations of the air quality standards.

2. Biological Environment

a. Impact on Intertidal Benthos

i. Discussion: As discussed in Section II.B.2, the intertidal shorelines of central-northern California are made up of approximately 50 percent rocky shore and 50 percent sandy beach (Visual No. 5 in BLM, 1980). The rocky and boulder intertidal beaches of central-northern California support a very diverse and abundant assemblage of invertebrates,

seaweeds, and marine plants. Populations of sandy beach organisms are sparse in comparison with rocky shore populations. Most of the interidal shorelines of central-northern California receive relatively little human usage. As a result of this low level of human activity, many of the intertidal habitats support undisturbed, natural communities.

Oil spills from platforms or tankers and the installation of pipelines would cause impacts to intertidal shorelines. Drilling platforms and related activities are not expected to cause impacts to intertidal communities 3 or more miles away. Further analysis of oil development impacts on intertidal areas can be found in Section IV.A.8.b, BLM (1975, 1979, and 1980) and National Academy of Science (1975).

Oil Spills - Rocky Intertidal. Offshore oil and gas activities sometimes result in an accidental release of oil. Based on the Oil Spill Risk Analysis Model, one spill greater than 1,000 bbl is expected to occur as the result of oil activities in the proposed sale area. No oil spills are expected for the Santa Cruz and Bodega or northern Santa Maria Basins (see Section IV.A.4 for a complete discussion of the Oil Spill Model). In addition, several small spills of less than 1,000 bbl are expected to occur over the entire porposed lease sale area.

Impacts from a large oil spill cause mortality to rocky shore intertidal organisms from smothering. Toxic related mortality is also possible, particularly if oil were to reach shore in a matter of hours.

The 1969 Santa Barbara oil spill (77,000 bbl*) is the best example of a platform oil spill we have available to estimate impacts in the proposed sale area in terms of similarity of organisms, habitat, geographical location and type of oil. Chan (1972, 1973, and 1977) conducted a thorough study on Duxbury Reef, near San Francisco; however, the impacting oil from that spill was a refined Bunker C oil. Refined oil is typically more toxic than crude oil.

Since the oil spill model used in this EIS defines large spills as those greater than or equal to 1,000 bbl, the probability of an intertidal area actually being contacted by a spill that might cover an area as extensive as the Santa Barbara spill would be less. Consequently, the potential impacts caused by a large spill for the majority of intertidal areas will be lower than the moderate impacts that occurred during the Santa Barbara spill (Straughan, 1971; Foster, et al., 1971). The impacts caused by a large spill to certain areas believed to be sensitive (Table III.B.1-1), however, would be the same or possibly greater than those during the Santa Barbara spill.

*Allen, A.A., 1969, Testimony before the Subcommittee on Minerals, Materials, and Fuels of the Committee on Interior and Insular Affairs, United States Senate, 91st Congress, May 19-20, 1969.

During the 1969 Santa Barbara oil spill, certain species experienced mortality of up to 100 percent, while other species experienced noticeable mortalities, were harmed only slightly, or were apparently unharmed (Straughan, 1971; Foster, 1974; Foster, et al., 1971). The extent of damage from oil spills depends largely on the residence time of the oil on the impacted intertidal area (Hayes and Grundlach, 1979). Residence time on steeply inclined intertidal areas will be brief and impacts consequently should be low (a short-term insignificant interference with ecological relationships lasting less than a year). Broad flat intertidal surfaces could retain oil for several days. The length of residence time on flat or gently sloping intertidal surfaces will depend upon tidal height and whether or not the oil is moved away from the impacted area during high tide cycles. Oil impacting flat broad intertidal platforms and shallow tide pools will usually cause moderate impacts (significant interference with ecological relationships that will last for less than 2 years).

Recovery of the damaged intertidal communities to a pre-disturbance structure will depend upon the vertical level of the intertidal zone impacted (Murray and Littler, 1979, 1980). The upper barnacle zone should require the least time to recover (approximately 1 year). The more structurally-complex middle- and lower-levels would require the greatest time for recovery. These structurally complex communities are mature communities which have been established for a fairly long time and have many species which live for long periods. The life expectancy for a large number of species has not been reported in the literature (Vesco and Gillard, 1980), although the majority of macroinvertebrates which have been reported have life potentials of over 5 years. Community interrelationships have become established which are thought to be the primary factor controlling the composition of the community (Carefoot, 1977). Such communities require a long time to recover if they are severely altered. Recovery time for communities within these areas will vary from over 1 year for certain seaweeds, up to 10 years for a mussel bed. Mussels, the structural foundation of mussel bed assemblages, have not suffered apparent mortality during high impact oil spills (Chan, 1975).

Except for rocky intertidal areas isolated from other areas by sandy beaches, channels, etc., recovery would be expected to begin within a year after the disturbance, and reproductive maturity achieved within 5 years. At isolated locations which have been heavily impacted, repopulation could be retarded for possibly a year because larvae and spores from impacted species would have to come from areas outside the impacted area rather than from within it. This condition is particularly true of the brown algae which have very limited dispersal abilities. Once repopulation commences, recovery would proceed normally, although other dominant species could out compete the original species as a result of advantageous settling times.

Table III.B.1-1 lists rocky intertidal areas in Central California which are believed to be more sensitive to oil spill impacts than other areas of the coast. The selection of these areas was based upon their having broad flat rocky platforms, isolation from other rocky intertidal areas, biogeographic location, and potential or past scientific study history and input from several intertidal biologists who are familiar with parts of the coast (see

have been identified in Southern California such as Santa Barbara and Santa Nicolas Islands (BLM, 1980) have been identified at this time. Sensitive biological areas such as this are not known to exist in Central California, although this could be due to a lack of highly detailed studies at a sufficient number of areas. Except for the Farallon Islands, there are no isolated islands such as occur in Southern California. The Farallons are not known to have a unique intertidal assemblage.

The impacts on the areas listed in Table III.B.1-1 are expected to be moderate from a large oil spill, except for possibly Duxbury Reef area where prolonged exposure would cause a high impact (a significant alteration of ecological relationships which lasts over 2 years).

High ecological losses to rocky intertidal areas cannot be positively ruled out, however. This would be particularly true in the event of multiple spills hitting the same area before reproductive recovery has been obtained. The greatest long-term impacts to rocky intertidal communities would result from several large oil spills hitting the same area every few years before recovery is complete. The oil spill model, however, predicts only one spill for the entire sale area, so multiple spills are not expected.

The time for recovery from a high ecological loss would not be the same in all areas listed on Table III.B.1-1. Some areas in Central California are isolated to some extent from other rocky intertidal areas and would probably take longer to recover than areas not isolated. Two areas, Point. Arguello and Point Conception, are also near or at the dividing line of the Oregonian and California Biological Provinces (Valentine, 1966). More invertebrates have their entire geographic restricted to this general area, including the Santa Barbara Channel, than anywhere on the coast.

Oil Spills - Sandy Beach Intertidal. The impacts on sandy beach intertidal assemblages at areas of high wave energy, typical of the central-northern coast, have not been as high as on rocky shore intertidal communities. Impacts from a large oil spill are typically expected to be low. However, if the wave energy is low, residence time of oil on sandy beaches can be longer than on rocky shores. If oil is retained on a sandy intertidal beach for long periods, community members, such as clams, may suffer a high ecological loss. Indirect damage could result from the cleanup operations following a large oil spill. These activities could result in the total destruction of local communities.

The extent of impacts resulting from chronic oil pollution are not well known. However, it is doubtful that a rocky or sandy intertidal area would receive significantly prolonged exposure from chronic effluents or the several small spills (Section IV.A.4) to cause significant impacts. The distance of three or more miles from platforms to shore, would allow dilutions and weathering of the small amounts of oil that might remain to reach shore to become both less toxic and less concentrated. Variable currents and wind patterns would prevent most intertidal areas from receiving chronic oil pollution consistently. Impacts are not expected to exceed the low level.

Pipeline Installation. Impacts on rocky and sandy intertidal shorelines could also result from the installation of subsea pipelines. During installation, damage to the communities within an area about 20 m wide would occur where the pipelines come ashore. Such damage would result from digging trenches, blasting

through rocky intertidal areas or from equipment used on the habitats. Recovery from this type of disturbance should proceed normally. Such impact is considered to be low.

PROPOSED SALE AREA

Impacts within the Proposed Sale area are expected to be low.

Oil Spills - Rocky Intertidal. Although one large oil spill is predicted for the Proposed Sale Area, the probability of it reaching an intertidal area is low (8 percent or less) and therefore not expected. Since no oil spills are expected to contact an intertidal area in this area, significant impacts are not expected. However, if a large oil spill were to contact a sensitive rocky intertidal area (Table III.B.1-1), the potential impacts are discussed below.

The sensitive rocky intertidal areas of the proposed sale area can be divided into 2 areas. The first area within the Santa Maria Basin considered sensitive is the area beginning just north of Spooner Cove and extending to Point San Luis. According to Burge and Schultz (1973) repopulation comes entirely from within this area of coastline. The potential impact from a large oil spill to this area is moderate, although a high impact cannot be completely discounted.

The second area contains somewhat isolated areas (Pirate's Cove through Point Conception) with the last three on the list being the most critical. Point Conception is the dividing line between the Oregonian and Californian Biogeographical Provinces. These isolated intertidal areas are consequently in a transition zone assembly having endemic species as well as the southern and northern limits to the distribution of other species (Section III.B.1). Although the impacts from a large oil spill will most likely be moderate to the intertidal community in general, certain endemic species may be eliminated from a critical portion of their habitat or even from their existence. The knowledge of the geographic range, sensitivities and identification of endemic species within these areas is not well enough known to predict their potential impact. As with other areas a high impact to these communities cannot be completely discounted.

Oil Spills - Sandy Beach Intertidal. Impacts to the sandy beach intertidal in the proposed sale area are expected to be low. An exception to this may be the Pismo Beach region which has several areas supporting large pismo clams (Section III.B.1). A large oil spill striking this area may cause a moderate to high ecological impact to the pismo clam population. The incidence of heavy surge around Pismo Beach is apparently not as frequent as in the northern part of the State (see Table IV.E.2.g-1). The decreased heavy surge would allow oil to remain within the sediments longer increasing the possibility of a high ecological loss of pismo clams if hit by a large spill.

Of particular interest is the Nipomo Dunes which has a large number of endemic species. These species are located in the dunes above the high tide line and probably would receive little impact from oil spills. However, the cleanup equipment used to clean up oil stranded on the beaches could cause high to very high (cause a species or assemblage to become endangered or extinct) impacts to some of these species.

Pipeline Construction. According to the transportation scenario, a pipeline would go ashore north of Santa Maria. A 20-meter wide disturbance would occur for the length of the pipeline. This impact ordinarily considered to be low may be increased to high for some of the endemic species in the dunes, since the pipeline is projected to cross a section of the Nipomo Dunes.

AREAS OUTSIDE THE PROPOSED SALE AREA

Central California. Since no large oil spills are predicted from tankering, significant impacts from oil spills are not expected.

Oil Spills - Rocky Intertidal. Should a large spill occur due to tankering and contact sensitive intertidal areas, the impacts would be as discussed below.

The sensitive rocky intertidal areas (Table III.B.1-1) include the Point Reyes Headlands which possesses abundant flora and fauna, particularly the mollusk populations. The potential impact for this area, should it be hit by a large oil spill, is moderate.

The second rocky intertidal area is the Agate Beach-Duxbury Reef. It is a broad extensive flat intertidal platform and is somewhat isolated from other rocky intertidal areas and potential brood stock. Because of the extensive flatness of these platforms, the potential of a high ecological loss resulting from a large oil spill is probably the highest of all areas in central-northern California.

The regional impact from a large spill for the Bodega Basin area should be low. Other rocky intertidal areas, in addition to those classified as sensitive, are present in the region. This is particularly true of the coastline north of San Francisco Bay to nearly Bolanus Lagoon. A large spill is not expected to cover the entire rocky intertidal areas within the basin.

If a large oil spill were to occur and contact sensitive intertidal in the Santa Cruz Basin, impacts would be moderate to high. Sensitive areas include James Fitzgerald Marine Reserve through Pillar Point., Ano Nuevo Island, the Monterey Peninsula and Carmel River State Beach to Soberanes Point., including Point. Lobos Reserve. The final sensitive rocky intertidal area in the Santa Cruz Basin is the Farallon Islands. Their isolation caused them to be placed on the sensitive list. Although a large oil spill would probably cause a low to moderate impact, recovery could be greatly retarded because of the island's isolation from brood stock.

Sensitive rocky intertidal areas within the northern Santa Maria Basin include Piegras Blancas Point. and Cayucos to San Simeon Point. The potential impact to these areas from a large spill is moderate although a high impact cannot be completely discounted. Since this stretch of rocky intertidal is continuous, recovery should proceed normally.

Oil Spill - Sandy Beach Intertidal. Should a spill occur, impacts to most sandy beach intertidal in Bodega and Santa Cruz Basins are expected to be low. However, Woodward-Clyde (1982) list Dillon Beach Harbor and Half Moon Bay as important clam areas. Monterey Bay beaches may be more sensitive. The impact from a large spill in these areas may be moderate.

Southern California. The Channel Islands Marine Sanctuary consists of the Channel Islands plus a 6-mile buffer zone. One spill is expected to contact the buffer zone surrounding the northern Channel Islands (probability 0.26 within 30 days). No spills are expected to contact the islands themselves. Therefore, impacts to the intertidal benthos are not expected to be significant. However, should a spill occur and contact the Islands, sensitive intertidal areas would be affected (BLM, 1981). Although the most likely impact from a large oil spill is moderate, the following areas have been identified as strong candidates for high impacts (BLM, 1981): San Nicolas Island (N.W. corner), Santa Barbara Island, Santa Rosa Island (Northern shore).

ii. Conclusions: Impacts to Central California intertidal areas would not be expected to occur due to the proposed action. However, if a large oil spill occurred and contacted a sensitive rocky intertidal area impacts could be moderate (a significant interference with ecological relationships lasting less than 2 years) to high (a significant interference with ecological relationships lasting two or more years) for the oiled intertidal area.

Pipelines crossing the Nipomo Dunes in the proposed sale area could be high to endemic dune species.

iii. Cumulative Impacts: Of particular concern to the intertidal areas, may be visitor use for food gathering and walking on sensitive intertidal areas. California Fish and Game (Frey, 1971) regards visitor use as one of the most detrimental impacts to intertidal areas.

According to the oil spill model, there are an expected 3 large oil spills from oil development and 5 additional large spills from tanker accidents. These spills increase the probability that at least one large spill will occur and contact a sensitive intertidal area. Sensitive rocky intertidal areas having probabilities of 25 percent or greater of a spill occurring and contacting them within 3, 10, and 30 days are shown below:

Intertidal Area	3, 10, 30 Day Hit Probability		
Point Reyes Headlands	11	31	45
Agate Beach/Duxbury Reef	46	52	52
Point Arguello	15	24	25
Point Conception	15	24	25

Based upon this information, we can expect moderate impacts to Agate Beach/Duxbury Reef and the Fitzgerald Marine Reserve (the 3-day arrival period is the most critical, since oil has the greatest chance of having some toxic components remaining) and possible moderate impacts to the remaining areas listed above.

Areas outside sale area having greater than 25 percent, 10-day occurrence and hit probabilities, include the Southern California coastline from Point. Conception to just north-west of Mugu Lagoon and the Palos Verdes Peninsula. Impacts to these areas should be low to moderate.

The northern shores of San Miguel, Santa Rosa, and Santa Cruz Islands have

37, 40, and 43 percent 10-day occurrence and hit probabilities, respectively. The 30-day probabilities range from 45 to 55 percent. The most sensitive of these islands is probably Santa Rosa where a high impact is likely, while the impacts for the other areas would be low to moderate.

b. Impact on Subtidal Benthos

i. Discussion: The continental shelf of central-northern California gradually slopes to the continental slope. Although it is periodically cut by canyons or interrupted by biologically important shallow banks or sea mounts, the shelf along central-northern California is a typical continental shelf in contrast to the atypical Southern California continental shelf. Although little information is available on the bottom communities of the region, it is reasonable to assume that they are productive and diverse owing to the indirect evidence of abundant upwelling and high fisheries landings. See Section III.B. for a further description of the subtidal benthos.

Activities which may adversely impact subtidal dwelling organisms include: emplacement of drilling platforms, discharge of drill cuttings and muds, pipeline construction, and oil spills. For further information on these impacts in general, refer to Sections IV.A.4.b and IV.A.8.b.

For additional coverage of oil production related impacts on subtidal benthos, refer to BLM (1975, 1979, and 1980).

Impacts from Platforms, Drilling Muds, and Drill Cuttings. Impacts from platforms and drilling muds and cuttings are covered together because they impact the bottom in the immediate vicinity of the platform. The nature of a soft bottom area under a permanent platform may be changed for a radius of 10 to of 100 meters for at least the life of the platform. This is caused by organisms, especially mussels, that are attached to a platform and eventually fall off, creating a different bottom substrate beneath the platform.

Soft bottom communities can also be impacted by drilling muds and drill cuttings. The area impacted by drill cuttings will vary slightly with depth and current velocity. The majority of heavy cuttings together with some entrained drilling muds will quickly settle to the bottom, form a pile which may be several feet thick under the platform, and gradually decrease away from it. Within a maximum radius of 100 meters of the platform or rig, most of the benthic organisms will be buried and the sediment composition of the bottom will be altered.

The area of bottom covered by drilling muds will vary significantly with depth and currents. Menzies, et al., (1980) reported impacts on benthic communities for a distance of 800 meters. As a conservative estimate, we assume the maximum distance for sublethal, but detectable impacts on benthic assemblies from drilling muds is 1,000 meters.

The communities within sediment bottoms probably will recolonize after a period of time; however, this colonization may not be by organisms characteristic of the surrounding area. Recolonization will come both from within the buried sediments and from outside larval settlements. Impacts from drilling muds and drill cuttings are of shorter duration than permanent platforms and are probably of less consequence. However, the impacts occur concurrently at least as long

as wells are drilled from the platform, or about 20 years.

Additional information on impacts from muds and cuttings are described in Section IV.A.8.b. Moderate impacts, (a significant interference with ecological relationships for less than 2 years) will occur in the immediate vicinity of the platform on the bottoms which are recolonized by original species in addition to the organisms which fall from the platforms. However, since impacts will probably remain localized, the impact to the generally soft bottom outside the impacted area will be low (short term, lasting less than 1 year, with insignificant interferences with ecological relationships).

Platforms could also alter the assemblages on hard bottoms for a radius of 100 meters. As with soft bottoms, impacts are caused by organisms falling from the platform structure and creating a different bottom surface and assemblage.

The highest impacts from drilling muds and cuttings to hard bottoms will be in those areas where the currents are weak. In these areas, the highest concentration of muds and cuttings will pile up and settle at the drilling site. Where the cuttings and muds pile up, the composition of the bottom will become altered and most organisms will be buried within a radius of 10 to 100 meters around the platform or rig. Because the bottom substrate may change following the discharge of muds, cuttings, and associated impacts from platforms, recolonization will consist of species different from the original inhabitants. Additional, probably small, impacts for as far as 800 to 1,000 meters are possible from drilling muds. If platforms are not concentrated on hard bottoms, the resulting impacts are expected to be moderate to high (significant interference with ecological relationships which last for two or more years).

If platforms are concentrated on hard bottom reefs, such as Cordell Banks, the ecology of the entire hard bottom area could be altered, resulting in a high ecological impact.

Impact from Pipelines. Pipelines may disturb soft bottoms for an area 20 meters wide along their axis. Anchors may also cause a disturbance from being dropped and pulled along the bottom when pipelines are being layed. The disturbance will not be continuous from pipeline to anchor, but will occur at a horizontal distance of 3 to 7 times the depth of the anchor (see Section IV.E.17). Trenches and mounds which apparently can remain for over a year in certain soft bottoms result from this procedure. In bottoms consisting of coarser sediments, like sand, the mounds and trenches probably do not remain as long. Assuming the composition of the bottom sediments remains the same from the pipeline or anchor disturbance, impacts to the soft bottom communities would be low.

Pipelines transversing hard bottoms would cause disturbances of the same dimensions given above for soft bottoms. The impacts to hard bottoms will be moderate to high in the path of the pipeline. Attached organisms will be crushed by the pipelines or anchors and repopulation will have to come primarily from larval settlement. The time required for the community to recover to its original structure will be from 1 year for kelp, to approximately 10 years for mussels.

Impacts from Oil Spills. Impacts from a large oil spill, caused by smothering and toxic fractions of the oil, on soft bottom communities generally would be low. This would be particularly true at deeper bottoms where dilution of the oil would be greater before it reaches the communities on the bottom. There is a possible danger of mortality to more sensitive species, particularly microcrustaceans.

Spies, Davis, and Stuermer (1980) compared the benthic assemblages at a natural oil seep near Santa Barbara with an area away from the seep but within the same assemblage. Benthic population densities were actually larger at the seep area. The difference was thought to be due to trophic enrichment by bacterial growth stimulated by the petroleum at the seeps. Much of the population increase was due to an increase in oligochaete worms which thrived on the bacteria. Most of the dominant species populations were also higher at the seep site. Gammerid amphipods (microcrustaceans), however, had lower population densities at the seep sites.

Some of the smaller shrimp and crablike organisms (microcrustaceans) are reported to be particularly sensitive to oil contamination and would probably be among the first of the benthic organisms to be impacted by an oil spill.

Impacts from oil spills on the subtidal hard bottom communities will generally be low. Although these impacts may be low, the destruction of unusually sensitive species, particularly microcrustaceans, or species endemic to the area is possible, although the likelihood is probably low. A high impact may occur if a species that has an important community function is destroyed on a particularl reef or hard bottom area from an oil spill. The community may be significantly altered until the population of the impacted species is replaced by brood stock from other areas. Until ecological relationships on subtidal hard bottom communities are better understood, the likelihood of such an impact is unknown.

Impacts to the benthic community could be increased if more than one oil spill hits the same area before the benthic community had time to recover from a previous oil spill. Impacts under these circumstances could be raised to moderate or even high. According to the oil spill model, multiple oilings will not occur, since there are less than two spills predicted for the entire sale area.

Little evidence exists that kelp is harmed by oil. Under extremely heavy repeated oilings, the reproductive biology of kelp may be interfered with, but this is speculative. The impact will be the mortality of many canopy associates which range from invertebrates through fish. Particularly susceptible are probably the microcrustacea, especially mysids. Because of rapid reproductive rates and short life cycle, (North, 1972) the population of most of these associates should return to prespill levels within a year.

If the planktonic stage of benthic invertebrate species happened to correlate with a large oil spill, those species could experience poor survival for the year class in the particular region of the spill. The effect on the ecology of subtidal communities of the region from such an impact is not possible to predict.

It should also be noted that when mechanical oil spill equipment is not effec-

tive, dispersants may be used; however, the dispersed oil is generally found in the upper portion of the water column and would not reach bottom communities. The extent of impacts resulting from chronic oil pollution is not well known (see Section IV.A.8.b).

PROPOSED SALE AREA

Platforms, Drilling Cuttings and Drilling Muds. The 5 production platforms, temporarily exploratory platforms and their associated drill cuttings and muds and single pipeline expected for the Santa Maria Basin would cause moderate to high ecological losses in the immediate vicinity of the platforms, but regional impacts to the basin should be low. However, if wells are drilled or platforms placed on rocky outcrops, high impacts are possible. High impacts would occur if rare or sensitive species with important ecological functions are present. Since the composition of, and function within, these communities is unknown, we cannot predict the most serious impact. However, several platforms in a sensitive area would increase the possibility of a high impact.

The topographic highs, reefs and known rocky outcrops (Graphic No. 2) of concern in the Proposed Sale Area are: the large Santa Luca Bank, two already leased banks off Santa Maria, and scattered rocky outcrops off Point. Arguello. As in the other basins impacts could be high if drilling on platforms are placed on these rocky outcrops. Several of the areas have been surveyed to varying degrees (Hooks, McCloskey and Associates, 1982; Nekton, 1982; and Dames and Moore, in press).

Eleven apparently new species have resulted from these studies, but no species thought to be sensitive or rare were reported. Due to the paucity of studies on similar habitats in the area, these conclusions may be a little premature. Interrelationships within the community are not well known, in any case.

Oil Spills. According to the oil spill model, one oil spill is expected to occur in the Santa Maria Basin as the result of Proposed Sale No. 73. If the spill should occur and contact a subtidal community, the impacts to hard and soft bottoms would most likely be low. However, a high impact to hard bottoms is possible in circumstances similar to those discussed in the paragraph above.

AREAS OUTSIDE THE PROPOSED SALE AREA

Central California. Since no drilling or oil spills are expected in Central California, there would be no platform, drilling, or oil spill related impacts Since no large tanker oil spills are predicted for the Bodega, Santa Cruz, or northern Santa Maria Basins, significant impacts to subtidal communities due to oil spills are not expected. However, if a spill should occur, the most likely impact to both hard and soft bottoms would be low. On hard bottoms, a high impact is possible if rare or very sensitive species with important community functions are present. Since the composition of the community and ecological relationships of its members are unknown, the likelihood of such a high impact is unknown.

Southern California. Since no drilling is expected in Southern California, there will be no platform or drilling related impacts.

Oil Spills. Impacts due to the one oil spill expected to contact the Channel Island Marine Sanctuary should be similar to those discussed under the Proposed Sale Area above.

ii. Conclusions: Impacts to the subtidal benthos are expected to be low (an insignificant interference with ecological relationships lasting less than 2 years) from oil and gas production activities due to the proposed action. However, high (a significant interference with ecological relationships lasting for two or more years) impacts are possible from drilling on rocky outcrops within the proposed sale area. If a large spill occurred and contacted a rocky outcrop community, although low impacts would be most likely, high impacts would be possible.

iii. Cumulative Impacts: The impacts from the 17 or more additional platforms from previous sales should be similar to those discussed above. If, however, several platforms are placed on a large rocky outcrop, high impacts to the outcrop community would probably occur.

According to the oil spill model, there is an expected single spill resulting from this sale, 3 from existing leases and 5 from tanker imports. In addition, an unknown number of oil spills are expected to occur from development of oil and gas resources in State tidelands and other vessel traffic. Impacts from the 8 or more spills should be similar to those described above. If 2 or more spills occur within a brief period and contact a rocky outcrop, the likelihood of a high impact to the area would be increased.

c. Impact on Fish Resources

i. Discussion: Oil spills, manmade structures, routine effluents and discharges, and noise potentially can impact fish populations. The overall significance of these impacts to fish resources will depend on the number of fish populations affected and the magnitude of the impacts to these populations (see definitions of impact levels in Appendix A).

It is important to note that fish populations fluctuate dramatically under existing conditions, and any decrease or increase in the size of fish populations resulting from the proposal probably will be difficult to detect.

It is also important to note that reduction in the population size of one species (invertebrate, fish, mammal or bird) could affect other species in the food web. For example, many species feed on northern anchovies. If the number of anchovies in an area is substantially reduced, their predators may need to switch to another food source, if available, to survive. Consumption of this new food source could affect its population size as well. Conversely, reduction in the number of anchovies means the population size of the species it feeds on could increase. The marine food web is extremely complicated and it is not possible to assess how significant a reduction in the population size of one species due to the proposal will be to other populations. However, the fact that population sizes are interrelated needs to be recognized.

Oil Spills. Offshore oil and gas activities sometimes result in an accidental release of oil. These oil spills potentially can impact fish populations by causing: 1) behavioral changes (e.g., an avoidance reaction, reduction in

swimming behavior, or reduction in feeding behavior), 2) physiological changes (e.g., reduction in reproductive output, or other tissue changes), 3) habitat alteration (e.g., oiling of spawning substrate), and 4) a reduction in fish populations either indirectly as a result of 1, 2, and 3 above or directly as a result of oil toxicity or coating (see discussion in Section IV.A.4.b).

Since oil usually concentrates near the surface or in shallow nearshore areas, fishes that are the most vulnerable to oil spills are those that are concentrated in these areas during a significant part of their life cycle. These fishes include northern anchovy (all life stages), Pacific herring (all life stages) and anadromous fishes (juvenile and adult life stages). Squid (all have at least one life stage that inhabits the surface layer or shallow near-life stages) also are vulnerable to oil spills. Although many other species inhabit shore areas, they are not expected to be significantly impacted by oil spills since their egg, larval, juvenile and adult stages are so widely distributed in space or time that it is unlikely oil would contact a significant part of the population. (Also see Section IV.E.2.g concerning estuaries and wetlands.) Sometimes chemical dispersants are used to spread oil throughout the water column before it impacts birds or reaches shore. If dispersants are used, fish concentrated at the surface would be vulnerable to impacts (from oil or toxic components in the dispersants), but impacts to nearshore species may be reduced.

Anadromous Fishes. Anadromous fishes apparently use chemical cues to return to their native streams to spawn. Since oil could interfere with their ability to detect these natural cues, these fish are particularly vulnerable to oil when they first enter the sea as young and later when they return to spawn. Field tests have shown (Malins, 1980) that salmon will initially avoid an oil contaminated fish ladder but later some will use the ladder despite the presence of oil. Also, salmon have been shown to avoid oil in laboratory experiments (Rice, 1973). Therefore, a large oil spill (or many small oil spills) near the mouths of rivers probably would prevent some anadromous fish from returning to their native streams to spawn and delay the spawning runs of other fish. This could lead to a reduction in the fish populations. The anadromous fish populations that probably would be most affected are king salmon and silver salmon since: 1) these species die after spawning and successful spawning is very important to survival of these populations; and 2) these species are already stressed from fishing pressure and continuing habitat degradation. Interference with the spawning runs of these species during one spawning season could cause a moderate reduction in the size of these populations. Since salmon die after spawning and are stressed from fishing pressure and continuing habitat degradation, recovery is expected to be slow, taking 5 years or more.

Pacific Herring. During most of the year, Pacific herring are widely distributed and probably would not be impacted very much by oil spills. However, during certain periods of fall, winter, and spring, herring move inshore to spawn in San Francisco Bay, Tomales Bay, or less important spawning areas. Due to the sensitivity of herring to oil, a large oil spill (or many small oil spills) contacting these areas during spawning could cause a reduction in the population by: 1) contaminating spawning substrate; 2) causing egg or larval mortalities; 3) causing mortality of organisms upon which larval herring feed; and 4) causing adult mortalities. Since adult and larval herring spend a small amount of time in the spawning area, only part of the population would be impacted so the reduction would be expected to be moderate. Since herring

spawn several times during their life, recovery is expected to take a few (3-5) years at most.

Northern Anchovies. During most of the year, northern anchovies are widely distributed and probably would not be impacted very much by oil spills. However, during April-June large dense schools of anchovies, of up to several hundred tons, may be found during daylight at the surface within 20 miles of the coast. A large oil spill (or many small oil spills) contacting one of these schools could kill enough individuals to cause a small reduction in the population. Since northern anchovies are abundant and reach sexual maturity rapidly, recovery is expected to be rapid, taking 1-2 years.

Squid. During most of their lives, squid are widely distributed and probably would not be impacted very much by oil spills. However, when squid reach maturity in 1-2 years, they move inshore to spawn in large numbers. Since squid die after spawning, successful spawning is important to their survival. Of particular importance is the spawning area in Monterey Bay, since a very large number of squid spawn in a relatively small area. A large oil spill (or many small oil spills) in this area could kill enough individuals or eggs to cause a small reduction in the population. Since squid are abundant and reach sexual maturity rapidly, recovery is expected to be rapid taking 1-2 years.

Manmade Structures. Platforms, subsea pipelines, subsea wells, marine terminals and other manmade structures may be used during various stages of oil and gas activities (see discussion in Section IV.A.5). These structures potentially could have positive and negative effects on fish.

During placement and removal of manmade structures, declines in fish populations could occur since physically damaging fish feeding and reproductive habitats (e.g., trenching for pipeline burial), increasing turbidity, or blasting (e.g., to bury pipelines in rocky substrate) can kill fish. During regular operation of platforms, a few fish entrained in the seawater intake systems potentially could be killed. Since these effects would be localized near the structure, and most would be temporary (primarily during placement or removal of the structures), most species are not expected to be significantly affected. However, species which have essential feeding or reproductive habitats concentrated in discrete areas (e.g., petrale and dover sole spawning grounds) potentially could be significantly impacted if a large number of structures are placed in these areas.

The proposal also could have beneficial impacts on fish populations. Production platforms and probably other offshore structures act as artificial reefs that attract fish (Carlisle, et al., 1964; Simpson, 1977). The population sizes of some species (particularly rockfish) may actually be increased by the presence of these reefs. Platforms also could be used for mariculture operations (particularly for growth of mussels and abalones). Finally, adverse impacts to commercial and sportfishing operations (see Sections IV.E.3.e and f) could result in less fish being caught allowing fish populations to increase.

Effluents and Discharges. Several types of effluents and discharges, (e.g., drilling muds and cuttings, formation waters, and sewage) are routinely released into the ocean during offshore oil and gas operations (see discussion in Section IV.A.8.a). There are indications that these substances potentially

could produce sublethal changes (e.g., tissue changes, reduced growth, reduced reproductive output) or death in some fish populations (see discussion in Section IV.A.8.b). Although the impact that these materials will have on fish populations is not known for certain, few, if any, fish concentrated near drilling sites are expected to be affected, unless a very large number of wells are drilled in one area, due to the rapid dilution of these substances by ocean waters.

Noise. Geophysical vessel operations generate acoustic signals with the use of air guns (or steam, electric-spark, or gas-sleeve sources) to study the geologic structure below the sea floor (see Sections IV.A.6 and IV.A.7). These acoustic signals apparently harm very few if any fish (Falk and Lawrence, 1973; Weinhold and Weaver, 1973). However, fishermen have reported that after a geophysical vessel passes through an area, they catch fewer, if any fish. Thus, fishermen are concerned that the acoustic signals may frighten fish. Although not known with certainty, this type of behavioral change is expected to be localized and short-term (see discussion on fish frightened by explosives in Rulifson and Schoning, 1963). Therefore, noise from geophysical vessel operations is not expected to significantly harm or frighten fish unless, perhaps, a very large number of geophysical vessel operations occur at one time. Based on current limited availability of these vessels, this is very unlikely to occur.

PROPOSED SALE AREA

Oil Spills. In the proposed sale area, northern anchovies are the most vulnerable fish species to oil spills since they are the principal species that concentrate in the surface layer or shallow nearshore areas. However, little, if any, reduction in these populations is expected as a result of the proposal since, even though one oil spill is expected in the proposed sale area, the probability that it will contact one of the large schools of anchovies is very low. Although unlikely, if a large oil spill does contact a large school of anchovies, a small 1-2 year reduction in the northern anchovy population could occur.

Manmade Structures. Five platforms and 144 miles of subsea pipeline are expected to be placed in this area. Since it is unlikely that enough of these structures would be placed in one area to significantly affect any fish populations, little, if any, increase or decrease in fish populations due to manmade structures is expected.

Effluents and Discharges. One hundred and seventy-six wells are expected to be drilled in this basin over a 9 year period. Although unlikely, if all of these wells were concentrated in one area, a few fish could sustain sublethal or lethal impacts. Loss of a few fish near drilling sites is not expected to significantly affect any fish populations.

Noise. Noise from geophysical vessel operations is not expected to significantly harm or frighten fish since a limited number of geophysical vessels probably will be used in this basin at one time.

AREAS OUTSIDE THE PROPOSED SALE AREA

Central California.

Salmon, Pacific herring, northern anchovies, and squid are the most vulnerable species to oil spills in Central California since they are the principal species that concentrate in the surface layer or shallow nearshore areas. However, little, if any, reduction in these populations is expected as a result of the proposal since: 1) the probability that a large oil spill will occur and contact the areas near the mouths of rivers where salmon concentrate is very low even after 30 days (e.g., 0 percent San Francisco Bay, 1% San Lorenzo River), 2) the probability that a large oil spill will occur and contact Pacific herring spawning grounds is very low even after 30 days (e.g., 0 percent San Francisco Bay, 1 percent Monterey Bay), 3) the probability that a large oil spill will occur and contact a large school of anchovies or squid is very low even after 30 days (e.g., 1 percent Monterey Bay). Although unlikely, if a large oil spill contacts large concentrations of salmon, Pacific herring, northern anchovies or squid, there could be: 1) a moderate reduction in salmon populations lasting 5 years or more, 2) a moderate reduction in Pacific herring populations lasting 3-5 years, and 3) a small 1-2 year reduction in northern anchovy and squid populations.

Southern California.

Little, if any, impact from oil spills is expected since the probability of a large oil spill occurring and contacting this area is low even after 30 days (e.g., 14 percent Northern half of San Miguel Island, 4 percent Northern half of Santa Rosa Island, and 0-2 percent for all other areas). However, although unlikely, if a large oil spill occurred and contacted a large school of northern anchovies, or squid, a small 1-2 year reduction in northern anchovy or squid populations in Southern California could occur.

ii. Conclusions: The proposal is expected to result in very low impacts to fish resources (sublethal and lethal changes insignificant).

However, although unlikely, the proposal could result in a moderate impact to fish resources (moderate or high reduction in the population sizes of a few species) if a large oil spill contacts large concentrations of salmon, Pacific herring or northern anchovies. Specifically, although unlikely, the proposal could result in: 1) a moderate reduction in salmon populations lasting 5 years or more; 2) a moderate reduction in Pacific herring populations lasting 3-5 years; and 3) a small 1-2 year reduction in northern anchovy or squid populations.

iii. Cumulative Impacts: Without the proposal, fish populations in California are expected to decrease due to fishing pressure, sewage disposal, natural oil seeps, existing offshore oil and gas leases (State and Federal), new State leases proposed to be sold between Point Arguello and Point Conception, tanker transportation of foreign and Alaskan crude oil imports, and other vessel traffics (see Sections I.C, III.C.5, III.C.6, III.C.12, IV.A.4., IV.C.3, and IV.D for descriptions of these actions).

Fishing pressure is probably the most important stress on fish causing large to very large decreases in many fish populations (see Section III.C.5. and 6).

Oil spills from existing leases, proposed leases, tanker transportation of foreign and Alaskan crude oil imports, and other vessel traffic potentially could also be an important stress, particularly when added to oil from sewage disposal and natural oil seeps. Over the life of the proposal, 3 large and many small oil spills are expected to result from existing Federal leases (in the Santa Maria Basin and Southern California). Also, 5 large and many small oil spills are expected to result from tanker transportation of foreign and Alaskan crude oil imports (in California and Oregon). Based on the Oil Spill Risk Analysis Model, the areas expected to be contacted (by large oil spills) are near San Francisco Bay (Tomales Bay to Princeton) and the Santa Barbara Channel (mainland coast and northern halves of San Miguel, Santa Rosa and Santa Cruz Islands) (see Section IV.A.4.a). Other areas (particularly in Southern California) also may be contacted by oil since: 1) additional oil spills (number unknown) are expected to result from existing and proposed oil and gas development in State tidelands, and vessel traffic other than tanker

transportation of crude oil imports, and 2) additional oil (amount unknown) is expected to be released as a result of sewage disposal and natural oil seeps. The cumulative effect of oil from all of these sources is expected to result in: 1) a moderate reduction in salmon populations lasting 5 years or more; 2) a moderate reduction in Pacific herring populations lasting 3-5 years; and 3) a small 1-2 year reduction in northern anchovy and squid populations (see discussion above).

Many manmade structures exist or are expected to be placed in California waters as a result of existing offshore oil and gas leases (State and Federal) and proposed leases (State). See Section IV.D.4 for details. It is unlikely, however, that when all of the structures are in place that there will be enough concentrated in one area to cause a decrease in fish populations. Therefore, manmade structures are not expected to be a significant stress to fish.

At the same time, these structures are expected to cause a small increase in fish populations by: 1) acting as artificial reefs (e.g., increasing rockfish populations), 2) being used for mariculture operations (e.g., for growth of mussels and abalones), and 3) causing adverse impacts to commercial and sport-fishing operations (e.g., commercial trawl fishing for bottom fish).

Also as a result of existing and proposed oil and gas activities, a large volume of effluents and discharges have or are expected to be released into the ocean (see Section IV.D.4 for number of wells expected to be drilled without the proposal). Although unlikely, if a large number of these wells were concentrated in one area, a few fish (particularly those already stressed from other discharges such as sewage) could sustain sublethal or lethal impacts. Loss of a few fish near drilling sites is not expected to significantly affect any fish populations.

Geophysical vessel operations have been conducted in California for many years, and additional operations probably will occur as a result of existing Federal and State leases. Noise from these operations is not expected to significantly harm or frighten fish since a limited number of geophysical vessels probably will be used in this basin at one time.

The cumulative effect of all of these stresses of fish populations, particularly fishing pressure, is expected to cause large to very large decreases in fish populations. The very small (insignificant) additional stress on fish populations that the proposal is expected to add is not expected to significantly harm any fish populations.

d. Impact on Marine Mammals

i. Discussion: This section presents an overview of potential impacts agents on marine mammals including seals, sea lions, dolphins, porpoises, whales and the southern sea otter. Much of the information discussed below is excerpted from a review paper by Cowles (1981). Supplemental references and information were suggested in a 1981 draft background paper by Dr. F.R. Englehardt for the National Academy of Sciences.

Three classes of impact agents are considered:

(1) Oil;
(2) Human activity and noise; and
(3) Other potentially toxic impact agents such as drill muds.

the acute or short-term impacts on pinnipeds, cetaceans, and sea otters are known to some extent. Chronic or long-term impacts of oil, noise or stress are poorly known, due largely to the difficulty in studying these animals in their natural environment and the difficulty of conducting any type of controlled experiment in the open ocean.

The impacts discussed below are, based on limited data and, in some cases, extrapolation from terrestrial mammals including man. Estimated maximum potential impacts to marine mammals are tabulated in Table IV.E.2.d-1. This discussion deals only with physiological and gross behavior impacts. The marine mammals are known to have very large brains and complex interactions such as long distance communication, cooperative birthing and capulatory behavior. It is outside the scope of this document to speculate on potential impacts to the emotional or social structure of these animals from OCS Hydrocarbon activities.

OIL SPILLS. Oil from oil spills can impact marine mammals in several ways: 1) direct contact, 2) toxic effects from ingestion, both acute and long-term, 3) habitat disruption, and 4) disruption of food sources.

Direct Contact Effects. Sea otters are susceptible to thermal stress if oiled. This species minimizes heat loss with its fur rather than with a layer of blubber. Kooyman and Costa (1978) felt that exposure of sea otters to crude oil in natural environments "would probably cause significant thermal stress and could lead to hypothermia and/or pneumonia resulting in death." Exposure to dispersants would likely have the same effect.

Fur Seals, (northern and Guadalupe) would also experience hypothermia and death if oiled. Haired seal pups such as harbor seals may also be susceptible to thermal stress while dependent on their prenatal fur (lanugo) for

TABLE IV.E.2.d-1

	POTENTIAL IMPACTS FROM PROPOSAL[1]					EXPECTED IMPACTS FROM PROPOSAL[2]
	OIL				OCS RELATED NOISE & DISRUPTION	
	CONTACT	TOXICITY	HABITAT	FOOD		
Sea Otter	mo-vhi	vlo-lo	mo-hi			vlo
Seals and Sea Lions Rookeries	vlo-lo	vlo-lo			vlo-hi[3]	vlo
Fur Seals	hi	vlo-lo			vhi	hi
Baleen Whales						vlo
Toothed Whales						vlo

1. Very high (vhi), high (hi), moderate (mo), low (lo) for California population.
Very low or insignificant estimated impacts are to tabulated except under expected impacts. See Appendix A for a discussion of impact levels.

2. Expected impacts would occur due to the Proposal more than 25% of the time.

3. High only due to repeated disruptions.

maintenance of body temperature. Mortality of oiled seal pups may also occur due to drowning. Davis and Anderson (1976) reported the death of gray seal pups when their prenatal fur became oiled and they were apparently unable to swim. On the other hand, LeBoeuf (1971) reported no adverse effects to elephant seal pups after the 1969 Santa Barbara spill. In many observations of oiled pinnipeds, it has been difficult to correlate cause and effect.

Laboratory studies by St. Aubin and Geraci (1982), found petroleum hydrocarbons produced only "mild and transient damage" to dolphin epidermis and to date, there have been no observations of oil-covered whales. However, baleen whales may also contact oil while feeding. The Pacific right whale would probably be the most susceptible to baleen fouling since it is a true surface skimmer and might also skim oil. The gray whale might engulf oil in bottom sediments. Laboratory studies to date however, indicated baleen plates only remain fouled for a few hours to days. Should the baleen plates not clear in a short period of time under natural conditions, is possible that death could result. There is evidence that some of the marine mammals can detect oil and learn to avoid contact if possible. However, all of these animals must come to the surfact to breathe, and some feed on the surface. In a large spill, at least some of the animals would be oiled.

SPECIES ACCOUNTS - OIL CONTACT

Sea Otters - Analysis of the impacts to sea otters must consider the following information. Sea otters are expected to suffer high mortality due to direct contact with oil. Oil spills are known to vary tremendously in surface size depending on sea state, type of oil, currents, winds, etc.. The density of sea otters along their range will vary from zero to more than 50 per nautical mile depending upon the day, season and area. For purposes of this analysis the following assumptions were made.

1. The spread of an oil spill is 10 nm per 10,000 bbl.
2. Mortality due to contact is 75 percent.
3. The mean density of animals is 20 per nm and occurs in more than 25 percent of the samples.
4. Counts made by U.C. Santa Cruz on 25 May, 1981 (CCMS,1982) represent the relative distribution of otters along the coast in the spring

Based on the above assumptions, a 5,000 bbl spill that contacted the otter range would likely result in 4.7 percent mortality to the otter population (probability greater than 0.25); a 10,000 bbl spill would likely result 9.4 percent mortality. Assuming a maximum density of 52 per nautical mile, mortalities would be 12 percent and 24 percent of the population for a 5,000 and 10,000 bbl spill respectively. While a small oil spill, or one that contacts the coast where there are few otters may result in zero mortality, a large tanker spill could result in greater than 30 percent mortality.

The population has already gone through a "genetic bottleneck." (reduction of the gene pool due to very few animals remaining in the population) Additional mortality of over 25 percent or more of the California population

could reduce the give pool sufficiently to make recovery questionable.

Within the Santa Cruz and Northern Santa Maria Basins, mean sea otter densities are higher than in the southern Santa Maria Basin. A 5,000 bbl spill would likely cause moderate to high impacts (a moderate to major reduction in the population requiring several years to decades for recovery), , a very large spill, such as a tanker spill, would likely result in high to very high impacts (a major reduction in the population requiring decades to recover, in some cases recovery might not occur.

Within the southern Santa Maria Basin, sea otter mean densities are somewhat less. A 5,000 bbl spill is more likely and would be expected to cause moderate impacts; a very large spill - high impacts. (See Appendis A for a discussion of impact levels.) During the winter season, otters move north and impacts within the proposed sale area could be negligible.

Analysis of winds and currents by the oil spill model (OSRAM) indicates that if a spill occurres along the sea otter range within 10 miles of the coastline, there is an average probability of greater than 40 percent that it would contact the otter range within 10 days. Should a spill occur during the Fall, the probability of a spill contacting the otter range is as high as 89 percent in 10 days (LaBelle et al. 1983).

Northern Fur Seal. The only major breeding populations outside of Alaska are concentrated on San Miguel Island. Should a spill contact areas around the island during the breeding season there could be high regional impacts, that is, 15 to 30 percent of the entire California population might perish from cold related impacts such as hypothermia and pneumonia.

Guadalupe fur seals are also highly susceptible to oiling but the number present in Southern California is so small as to not be considered a population. However, should these seals recolonize San Nicolas or San

Miguel Islands and a spill occurred in the vicinity, impacts could be high to very high for the region, that is, jeopardy for the California population.

Harbor Seals - Very young pups are susceptible to cold stress if oiled. However, harbor seals are fairly evenly distributed along the coast. No colony appears to contain more than 5 percent of the population. Additionally young pups are only present during a few months. Adults are not particularly vulerable to oiling. Possible impacts are therefore very low. Impacts (mortality) from an oil spill should be limited to a small percent of the years pup production.

The remainder of the California pinnipeds (California sea lion, Stellar sea lions and elephant seals) are not thought to be particularly sensitive to oiling. Potential impacts from an oil spill are probably very low, that is mortality should be minimal.

Cetaceans - There are no known significant impacts to porpoises, dolphins or whales from contact with oil. Skin and eye irritations, blow hole and baleen fowling are expected to clear within a short period of time (see discussion above). Additionally, the great whales are relatively widely spaced (see Center for Coastal Marine Studies, 1982). It is unlikely more than a few whales would contact a spill should one occur. Therefore, potential impacts from an oil spill are estimated to be insignificant for all of the cetaceans.

Toxic Effects of Oil. Oil can enter the body by ingestion, inhalation, or through the skin (Englehardt 1977). The ability to detoxify or store hydrocarbons will depend on the fractions involved, the species of animal and the way oil enters the body.

Evidence of toxic effects of oil on marine mammals is very sparse. Changes in hormone balances were found by Kashin, et al (1963). In experiments conducted by St. Aubin and Geraci (1962), vomiting, reduced feeding, liver damage and high perasite levels were recorded. The authors did not attribute the effects to oil. However, experimental controls were insufficient to eliminate oil as a causitive factor. St. Aubin and Geraci also detected no lung pathology in ringed seals exposed to the volatile fractions of petroleum.

Because marine mammals are at the top of the food chain, accumulation of toxic materials is possible. Petroleum or other toxic materials may be stored in the fat and latter released during migration or breeding, when food consumption is low. St. Aubin and Geraci found detectable levels of napthaline (a persistent petroleum residue) is most tissues analysed from marine mammals stranded along the Atlantic coast, indicating some petroleum factions are being stored. The presence of mixed function oxidases, however, suggests cetaceans and possibly other marine mammals can detoxify petroleum (Malins, 1977). It is also possible, however, that the oxidases may convert petroleum to more toxic compounds which are then stored (Malins, 1981).

The effects of low-level chronic exposure to oil are not known. Exposure will most likely contribute further stress to any marine mammals already under stress. Among other effects, stress can lead to higher mortality and decreased reproduction. For a further discussion, see Bureau of Land Management (1980) and Cowles (1981).

Presently the impacts due to the toxic effects of oil are estimated to be very low (insignificant), that is, not measurable and do not significantly reduce the health of the population though th effects may extend for the life of the proposal. OCS activities should contribute very little to the oceanic hydrocarbon levels.

Habitat Effects of Oil. The colonial breeding behavior of seals and sea lions makes them vulnerable to oiling of their habitat. Geraci and St. Aubin (1980) felt that changes in feeding, diving, mother-pup interaction, herd organization, and haul out behavior may affect survival. Mike Bonnell at U.C. Santa Cruz is concerned that repeated disruption by small spills and human activities may cause desertion of prime pupping areas, which would lead to use of less desirable sites and reduced survival of young. Such an effect was recorded by San Nicolas, where increased military personnel activi-

ties caused the pinnipeds to clump on one area of island. Severe crowding resulted.

The impact levels of rookery disruption are discussed below under Human Activity and Noise.

Sea otters are vulnerable to oiling of their habitat. Oil tends to collect in the kelp beds. Otters use the kelp for rafting and anchoring their young while feeding. Oiling of their pelage through secondary contact with the kelp would likely result in death. It is uncertain whether otters can or would avoid oiled areas. Potential impacts to sea otters could be moderate to high.

Effects of Oil On Food. Lowry, et al., (1978 and 1979) reviewed machanisms by which prey species such as anchovies may be effected by oil toxicity. See also section IV.E.2.C. BLM (1980), Sale No. 53 contains the following comments on food:

> "Due to the patchiness of pelegic fish and plankton, food die-offs would be very local and recovery should be rapid."

Reproduction in colonially breeding pinnipeds is apparently limited by the availability of food. Even small changes in prey abundance may cause alternations in reproduction. However, even a fairly widespread die off should only effect the years pup production. It is doubful impacts would exceed the very low level, that is loss of a few percent of the years young.

HUMAN ACTIVITY AND NOISE. Cowles (1981) includes a comprehansive discussion of the variability of effects of noise on marine mammals. Cowles stated, "The responses of animals to acoustic stimuli have generally shown variance in behavioral and physiological effects dependent on species studied, characteristics of the stimuli ... transmission medium, season, ambient noise, previous exposure of the animal, physiological or reproductive state of the animal, etc."

Noise impacts may come from seismic activity, drilling, pipelaying, aircraft, normal platform activities, tankers, and crew boats.

Many marine mammals are apparently highly dependent on acoustics for communication, food location, special orientation and avoidance of predators. The toothed whales (porpoises, dolphins, killer whales, and sperm whales) have a highly developed ecolocation capability and may also stun prey with sound Norris (1978). Use of sound by the endangered baleen whales is less certain and hearing capabilities probably vary within the group (Cowles 1981).

In the laboratory, high frequency sound has caused permanent ear damage to marine mammals. It is also quite possible increased noise levels may cause stress to the animals much as industrial noise increases stress levels in humans. However, gray whales apparently acclimate to some level of human activity in their environment, as demonstrated by their areas. Dohl, et al., (1978) did spectulate that "the reasons for the apparent increase in utilization of offshore waters are unknown, but might be the result of increased human activity in The Bight, increased

gray whale numbers or some combination of both factors." However, some marine mammals are attracted to boat noise, while others show definite aversion. This appears to vary with seasons and particular animals.

Gales (1982) in a study of platform noise concluded that although low frequency components may be detected on the order of hundreds of miles, a more likely range for the detection by whales was on the order of a few hundred yards. Gales estimated 150 yards for the Santa Barbara area and 3500 yards of Lower Cook Tolit, Alaska. Although these sounds were well above the level of detectability, they were substantially less than those produced by supply and work boats. Platforms noise was apparently the same during production and drilling. However, some platforms were much quieter than others, suggesting platforms can be designed to reduce noise. The 5 platforms and additional seismic work will increase noise levels for gray whales. However, the majority of the population is within 2 mm of th shoreline. Mothers and calves are frequently seen in the kelp beds (Center for Coastal Marine Studies, 1982). All Proposed Sale No. 73 platforms will occur outside the 3 mile line. Therefore, noise from platforms should be sufficiently attenuated that platforms from Proposed Sale No. 73 should not cause changes in the migration route.

Seismic activity in the area has the potential to cause damage to the hearing apparatus of whales however, for damage to occur the animals would need to be in close proximity to seismic apparatus. While it is possible a few individuals could suffer ear damage over the life of the proposal, impacts to the poplulation should be very low.

Aircraft, crewboats, and crews are a serious concern for pinnipeds. Stellar sea lions and harbor seals spook easily from rookeries. California sea lions will flush just from a shadow and even elephant seals will abandon the rookery if sufficiently disturbed. Elephant seal pups would probably suffer mortality if the mothers are forced from the rookery. However, as mentioned under OIL SPILLS, the major concern is abandonment of the rookery for a less favorable site.

Should a spill occur nearby or human activities disrupt the rookeries, disruption of the rookery could cause loss of as many as half of the years pups or impair breeding behavior. Due to the loss of a significant portion of the years pup production recovery could take several years. However, with good contingency plans, these impacts should be avoidable. Areas of concern for pinnipeds and the potential impact levels are listed below. The potential levels of impact due to noise and disruption are based on the percentage of the California population present: 5-15 percent - very low to low, 15-30 percent - low to moderate, 30 to 60 percent - moderate to high, over 60 percnet - high to very high. The higher level would occur only if repeated disruptions caused rookery abandonment.

1. Farallon Islands (Santa Cruz Basin)
   Harbor Seals - vlo to lo
   Elephant seals - vlo to lo
2. Ana Nuevo (Santa Cruz Basin) - overall high potential
   Stellar sea lions - lo to mo.

Harbor seals - vlo to lo
Elephant seals - mo to hi

3. Northern Channel Islands (Southern California) - overall high potential
   San Miguel Island west end.
   Northern fur seals (2 colonies) - mo to hi.
   Elephant seals - lo to mo.
   California sea lion - lo to mo.
4. Leeward side of Channel Islands.
   Harbor seals - lo to mo.

POTENTIALLY TOXIC CHEMICALS. Drilling muds have been considered a possible source of rare matals which could be toxic in sufficient quantities. Formation effluents may also contain rare metals. Current information, however, indicates rare matals from those sources are not biologically available. In addition, bottom sediments disrupted during drilling may contain deposits of other contaminants such as hydrocarbons and DDT previously discharged into ocean waters. Available data on the bio-accumulation of toxic materials in marine mammals and other marine vertebrates is inconclusive. No one really knows how drill effluents will affect the marine food chain. Therefore, the presence or absence of long term chronic impacts is uncertain. At this time, impacts from drill effluents are expected to be insignificant due to dilution factors.

According to the Oil Spill Risk Assessment Model and the resource estimates discussed in Chapter II, one oil spill is expected to occur and contact land within 30 days as a result of the proposal. It is expected that if a spill occurs it will be in the Santa Maria Basin. Contact will most likely occur in the area of San Miquel.

PROPOSED SALE AREA

One spill is expected to occur in the Proposed Sale Area as a result of the proposal. However, no contact is expected with the coast. Therefore, since there are no significant pinniped colonies in the area, and no contact is expected with the sea otter range, impacts from oil spills are expected to be very low. Should a spill contact the otter range with the proposed sale area, likely impacts would range from low to moderate depending on the season (see discussion above).

Five platforms are expected in the sale area. If gray whales are more sensative to noise than expected, the platforms could cause some changes in migration patterns. The likely impacts would still be very low.

AREAS OUTSIDE THE PROPOSED SALE AREA

Central California. No oil spills or drilling operations are expected in the Bodega, Santa Cruz or northern Santa Maria Basins and disruption of rookeries should be avoidable. Therefore, expected impacts to all species are insignificant.

There are no significant pinniped impacts within the Bodega or northern

Santa Cruz Basins. However, in Santa Cruz Basin should an unexpected spill occur and contact rookeries or feeding areas associated with the Farallon Islands or Ano Nuevo, significant impacts would likely occur due to direct contact, toxicity and possible noise and disruption. Likely impacts to the southern sea otter, should an unexpected larger or very large spill occur, in the center of the range are from moderate to very high or jeopardy (See discussion above).

Southern California. One oil spill is expected to contact the 6-mile buffer zone around the Northern Channel Islands. No spills are expected to contact the remainder of the coast. The most likely area for contact in the Channel Islands is the northern side of San Miguel. Should the spill occur during pupping season (May to August) impacts to the northern fur seal could be high (15 to 30 percent mortality to the California population) due to oiling of the fur.

ii. Conclusions: Impacts to the northern fur seal are expected to be high (25 percent mmortality of the California population) if a spill occurs during pupping or breeding season. Impacts to all other species - seals, sea lions, whales, porpoises, dolphins and sea otters are expected to be very low.

iii. Cumulative: Without the proposal or any further OCS activities in California, marine mammals will suffer impacts from several sources over the next 25 years. Sewage, increased tanker and recreational traffic, expanding population centers along the Coast. Changing climatic conditions and other natural causes may also change marine mammal distributions. However, most whales and pinniped numbers are increasing annually and should continue to do so. The status of the southern sea otter is questionable. Until it is determined whether the population is still increasing or is decreasing, predictions are impossible.

With or without the proposal, some species are expected to suffer moderate to high impacts local impacts. Some species may suffer a general degradation in health due to pollutants. Overall, the impacts are expected to be low to moderate in both the positive and negative direction. Population numbers are expected to increase, however, general levels of health may be slightly reduced.

Eight oil spills are expected as a result of existing leases, foreign and Alaskan tankering. The Proposal is expected to contribute one oil spill and may contribute a small to large amount to the impacts on marine mammals depending on the size, trajectory and season of spills. The 30 platforms expected in the Proposed Sale area will triple the number of in Central California from existing State and Federal leases. If gray whales are more sensative to platform noise than is expected, the platforms could cause significant changes in migratory patterns.and possibly other aspects of population dynamics.

e. Impact on Seabirds

i. Discussion: Although a great deal of information is available, the behavior, physiology and life history of many seabirds is not well known. The number of birds and mechanism of impacts from an oil

spill are largely unpredictable or uncertain. Estimated impacts to seabirds, both short term and long term from OCS hydrocarbon exploration and development are based on analyses and extrapolation from limited data. Much of the following information on impact agents and levels is taken from review articles by R.B. Clark (in Press) and Holmes and Cronshaw (1977).

Potential impact agents from the Proposal include:

1) Oil spills and cleanup activities
2) Increased human activity and disruption
3) Potentially toxic substances

Oil Spills. Oil from oil spills can impact seabirds in several ways: 1) direct contact with floating oil, 2) toxic effects of oil, both short and long term, 3) habitat destruction, 4) food losses, 5) cleanup activities.

Contact effects of oil. Most of the immediate mortality or disabling of pelagic seabirds is due to floating oil contacting the plumage. Oil disrupts the fine feather structure; water-repellent, insulating and bouyant properties of the contour feathers are impaired.

Mortality will depend on the species involved. Evidence indicated that seabirds avoid or try to avoid making ocntact with crude oil. However, species such as the alcids, that forage underwater and spend the better part of their lives on the ocean surface are more likely to encounter oil. Moreover, these birds will often dive when threatened. This means of escape, in the presence of oil, is apparently not effective, for the bird is, while underwater, unaware of the location of the oil. Seabirds such as gulls that roost on land or spend more time on the wing are less likely to encounter floating oil, and are presumably more adept at avoiding oil by simply flying away (Nero, 1982).

The colonial nature (i.e., the tendency to nest, feed and rest in large groups) of some species of seabirds will also make the populations more likely to suffer high impacts. For example, Weins et al. (1978) calculated that due to their colonial nature, 30 to 50 percent of the St. George breeding population of murres could be eliminated by a 1,000 bbl spill.

The number of birds historically lost due to spills is variable. Mortality is influenced by weather, season, local feeding behavior, time of day, and type of oil as well as the species present. Based on beached bird data, Holmes and Cronshaw (1977) compared spills size with the number of recovered dead birds. Numbers ranged from about 50 to almost 13,000 birds recovered per 1,000 bbl of crude oil spilled. The fraction of total dead birds represented by the beached birds will depend on currents, winds, distance from shore, etc. In most instances beached birds are thought to represent well below 50 percent of the total mortality. Based on historical data, a large spill (1,000 to 10,000 bbl) might result in a few deaths or tens of thousands.

Woodward and Clyde (1982) are compiling an Index of Sensitivity to oil spills for central-northern California. Table IV.E.2.e-1 lists the relative level of concern for nesting species. For purposes of this analysis it is assumed that 50 percent of a colony of primary (1^{o}) concern can die in a large oil spill (greater than 1,000 bbl) and 25 percent of a colony of secondary (2^{o}) concern.

Some migrants, such as surf scoters, are commonly recovered after an oil spill. Other migrants such as sooty shearwaters become highly vulnerable to an oil spill when they congregate in dense flocks of over 1/2 million birds within an area the size of Monterey Bay. Historically, however, mass kills of migratory birds have been a a result of an unusual combination of weather and physical factors (see Holmes and Cronshaw (1977) for examples). Therefore, although possible, significant impacts to migratory species are not expected. Shorebirds and waders are also not discussed in detail because they have not shown up in significant numbers in beached bird data and therefore are assumed not to be seriously impacted by oil spills.
Table IV.E.2.e-2 adapted from Woodward and Clyde (1983) tabulates central-northern Calfornia seabird nesting colonies containing more than one percent of the California population for species determined to be of primary (1°) or secondary (2°) concern. (See Tables IV.E.2.e-1 and 2 for a discussion of criteria.) Tertiary (3°) concern species are not tablulated. It is assumed that impacts to these species will not exceed the very low (insignificant) level.

Calculations by Weins et al. (1978) and (1980) indicated recovery times may take 50 to 100 years. However, Clark (in Press) felt that recovery from spills was more rapid and The Royal Commission, Section 3.52 (1981) felt auk (alcid) colonies were actually increasing in spite of oil pollution in the North Atlantic. For purposes of this analysis it is assumed large populations will take several decades to recover after a large or very large spill.

Potential impacts to the California population of seabirds are listed in Table IV.E.2.e-2. These levels are based on the highest impact level likely at each colony. (See Appendix A for a definition of impact levels.)

Thirty-five percent, approximately 236,000, of California's seabirds nest on the Farallon Islands. If a very large (greater than 10,000 bbl) spill should occur in this area during nesting season, the regional impacts could be very high (over 30% reduction in some species; recovery taking decades) due to high mortality.

Toxic effects of oil. Most ingestion of oil occurs during preening (Nero, 1982). Acute toxicity may result from oil. Recovered birds have shown wasting of fat and muscle tissue, abnormal conditions of major organs such as the liver, kidneys and adrenals and inhibition of pituitary function (Holmes and Cronshaw, 1977). Recovered birds also show symptoms of severe dehydration (Berkner, personal communication) apparently caused by malfunction of the salt gland which regulates the water/salt balance. Several salt excretion studies indicate weathered crude may be the most toxic in respect to maintenance of water/salt balance (Clark, in Press).

Increased mortality may occur in bird eggs contaminated with fresh crude from the adults. This has been demonstrated for mallard ducks, Cassin's auklets

TABLE IV.E.2.e-1

CALIFORNIA BREEDING DISTRIBUTION, WORLD BREEDING DISTRIBUTION, AND VULNERABILITY TO OIL IN NEAR COASTAL WATERS OF SEABIRDS SPECIES FOUND IN CENTRAL AND NORTHERN CALIFORNIA.

Species	Breeding Distribution: California[2]	Breeding Distribution: World	Vulnerability to Oil[3,4] (due to behavior)	Overall Level of Concern[5,6]
Fork-tailed storm-petrel	Concentrated (Castle Rock)	Circum N. Pacific	Low	3°
Leach's storm-petrel	Concentrated (Castle Rock)	Circum N. Pacific & N. Atlantic	Low	3° (tertiary)
Ashy storm-petrel	Concentrated (Farallon Isl.)	California	Low	2°
Brandt's cormorant	Concentrated (Farallon Isl.)	West Coast N. America	Moderate	2° (secondary)
Double-crested cormorant	Regional (Primarily N. California)	N. America	Moderate	2°
Pelagic cormorant	Widespread	Circum N. Pacific	Low	3°
Western gull	Concentrated (Farallon Isl.)	West Coast U.S. & Mexico	Low	3°
Common murre	Concentrated (Castle Rock)	Pacific & Atlantic N. latitudes	High	1° (primary)
Pigeon guillemot	Widespread	Circum N. Pacific	High	3°
Cassin's auklet	Concentrated (Farallon Isl.)	N. America	High	1°
Rhinoceros auklet	Concentrated (Farallon Isl.)	West Coast N. America	High	1°
Tufted puffin	Concentrated (Castle Rock & Farallon Isl.)	Circum. N. Pacific	High	1°

Legend:

[1] Table 1 is adapted from Woodward-Clyde (1982).

[2] From Sowls et al. 1980.

[3] From Sowls et al. 1980, King and Sanger, Ohlendorn et al. 1978.

[4] Vulnerability is a function of the birds behavior (feeding, nesting, flocking, resting). The levels of vulnerability represent the possibility that a substantial number of birds will come into contact with oil within the study area, thereby potentially affecting the breeding population in California. Levels assigned are independent of sensitivity to oil.

[5] Overall concern for the species depends on a combination on the California and world breeding distribution and the vulnerability to oil.

[6] In the case where the California population is concentrated, only concentrated areas such as the Farallon Islands for Cassin's auklets will have the maximum sensitivity shown in the table.

TABLE IV.E.2.e-2

SENSITIVE SEABIRD NESTING COLONIES AND BIRD SPECIES OF EITHER PRIMARY OR SECONDARY CONCERN NESTING AT EACH LOCATION 1,2

	Potential Regional Impact Level Due to Oils 3,4	Ashy Storm-Petrel 2° Feb-Nov	Brandt's Cormorant 2° Mar-Aug	Double-Crested Cormorant 2° Apr-Aug	Common Murre 1° May-July	Cassin's Auklet 1° Mar-Sept	Rhinoceros Auklet 1° Uncertain	Tufted Puffin 1° May-Aug	Brown Pelican 2° Feb-Oct
BODEGA BASIN									
Fish Rocks							X	X	
Russian River Rocks				X					
Bodega Rock			X						
Gull Rock			X						
Point Reyes			X		X			X	
Double Point Rocks					X				
Point Resistance					X				
SANTA CRUZ BASIN									
Farallon Islands	hi-vhi	77%(hi)	36%(mo)	9%(vlo)	17%(mo)	80%(vhi)	28%(mo)	40%(hi)	
Bird Rock			X						
SANTA MARIA BASIN									
Bird Island			X	7%(vlo)					
Partington Ridge North			X						
Cape San Martin			X						
Piedras Blancas			X						
Point Arguello	lo						8%(lo)		
NORTHERN CHANNEL ISLANDS									
Anacapa West	hi			7%(vlo)					94%(hi)
Santa Rosa Island			X						
Castle Rock		X	X			X			
Prince Island	mo	12%(lo)	X			15%(mo)			

1. Adapted from Woodward Clyde (1982).

2. Colonies listed contain at least 1 percent of the California nesting population of species of primary or secondary concern. X indicates species between 1 and 5 percent of the California population at that site. Percentages are percent of California nesting population of the species.

3. Site locations and numbers of birds were obtained by Woodward-Clyde from Sowls et at. (1980).

4. Based on the assumption that 50% of a population of 1° concern and 25% of a population of 2° concern would likely be killed in a large oil spill. The relationship between colony size and impact level to the California population is as follows:

Very low (vlo) = less than 10% of 2° species or 5% of 1° species
Low (lo) = 5-15% of 1° species or 5% 10-30% of 2° species
Moderate (mo) = 15-30% of 1° species 30%-60% of 2° species
High (hi) = 30%-60% of 1° species, or greater than 50% of 2° species
Very High (vhi) = cumulative effects of several species of 1° concern or greater than 60%
See discussion for more details

and gulls (Clark, in Press). Brown pelican eggs were found contaminated on the east coast (Oil Spill Intelligence Report, 1982) but no study was made of the mortality.

Longer term or sub-lethal effects of oil include delayed and depressed egg laying, reduced hatching and reduced growth rate due to poor nutrient uptake. Experiments on sub-lethal effects have been limited. Some of the observed effects are undoubtedly due to laboratory conditions and applicability of these experiments to the marine environment has yet to be determined (Clark, in Press).

Birds that do not die from ingested oil will suffer reduced health and "few animals in poor condition survive very long in the natural environment" (Royal Commission on Environmental Pollution 1981). The level of mortality due to the toxicity of oil cleaned from feathers or ingested with food is uncertain. However, these impacts will add to the direct contact effects and delay recovery time.

Habitat loss due to oil spills. Most pelagic seabirds nest on islands, stacks or in protected rocky cliffs. Sandy beaches are important to the least tern and snowy plover. These areas are not particularly vulnerable to nest site destruction by oil. However, endangered clapper and black rails are completely dependent on the salt marsh vegetation habitat for nesting, roosting, and feeding. Other species such as loons and grebes construct floating nests of sticks in estuaries. Should a spill enter an estuary, mortality could be high.

Food losses due to oil spills. The impacts on seabirds will vary with each species. For example, terns and most smaller seabirds spend a large percentage of their energy budget in foraging. Phalaropes feed in areas near upwelling where both oil and krill have a tendency to concentrate and remain. Other species such as common murres feed in large groups, possibly in traditional feeding grounds (Briggs, 1982). Brown pelicans are almost entirely dependent on anchovies (Gress and Anderson, 1982). Birds such as those described above that are concentrated for feeding, feeding on one prey species, or that spend a large percentage of their energy budgets foraging are vulnerable to local losses of food due to an oil spill, since oil from an oil spill could reduce the abundance and distribution of prey species. See Section IV.E.2.c for a more detailed discussion of impacts to fish.

Food shortages may lead to canabalism, prolonged juvenilism or delayed productivity. In California, food shortage limits reproduction but seldom limits adult survival. Breeding colonies tend to be located where food is abundant and fluctuations are buffered. However, reproductive success decreases sharply below a threshold forage ability (MacCall). Dan Anderson reported a significant correlation between anchovy populations and breeding success in brown pelicans (Anderson and Griggs, 1982).

Estuarine habitats such as used by least terns and rails could potentially be the most severely impacted. These species use estuaries for both feeding and breeding. An oil spill that entered an estuary might destroy nest sights and feeding areas for 2 to 10 years (Woodward and Clyde, 1983). Waterfowl also make extensive use of estuaries for overwintering and migration. Waterfowl are highly sensitive to oil. Potential impacts due to loss of food, should a spill enter an estuary, are high.

Cleanup activities after an oil spill. The use of dispersants may present as great a hazard to seabirds as spilled oil. Although new dispersants have been developed that are reportedly no more toxic than the oil itself, testing on birds and mammals has been very limited. Dispersants that will break up petroleum also break up the protective oils coating bird feathers; loss of insulation and buoyancy can result, causing hypothermia and death. Impacts, should seabirds contact areas where dispersants have been used, are potentially the same as for oil contact. However, the area of ocean sprayed with dispersants will usually be much less than the area covered by an oil spill. Ultimately impacts will probably be lessened, in the event of a spill, if dispersants are used. Dispersants would not be expected to affect shorebirds or estuarine species simply because there would be less opportunity for contact.

Impacts form the noise and disruption associated with cleanup activities are discussed below.

Noise and disruption. Increased human activity in the area can result from platform activities, pipelaying, aircraft, boats and from spill cleanup equipment and personnel. Several of the species, such as murres and brown pelicans flush easily from nests, leaving young and eggs open to predation and exposure. Mortality could range form a few percent to a large proportion of the nestlings depending on the duration and extent of the disruption. Aircraft flying at 1000 feet flush 10 percent of a nesting murre population. The effect seems to increase in remote areas where birds are unaccustomed to aircraft. Repeated disruption may cause abandonment of a rookery by sensitive species.

In a nest area, cleanup equipment and personnel could jeopardize a sizeable proportion of a nesting population. If only the young of the year are lost, recovery of a colony could take five or more years and the impacts would be low to moderate for the colony. However, if the colony is partially abandoned due to disturbance and new sites must be located, recovery could take much longer and impacts could be high for that colony. Impacts to the California population would depend on which colony was disturbed. See Table IV.E.2.e-2 for a list of colonies of concern.

Potential toxic substances. The long-term effects of other contaminants to the environment from OCS oil-related activities are discussed in Section IV.A.8 and IV.E.1.a (water quality). Likely long term impacts due to drill effluents are very low due to the dilution factor.

Pipelaying and drilling may also stir up old sediments, releasing chlorinated hydrocarbons or other industrial wastes into the marine environment. Impacts from these chemicals on seabirds are known to be very high at times. The endangered status of the California brown pelican is due to the presence of chlorinated hydrocarbons in the environment. However, the quantities of sediments disrupted are not expected to produce significant impacts due to the small quantities involved, and the dilution factor.

PROPOSED SALE AREA

Impacts to seabirds within the proposed sale area are expected to be very low since spills are not expected to contact significant seabird areas.

A large spill (greater than 1000 bbls) is expected to occur within the proposed sale area. The seabird colony of greatest concern is at Pt. Arguello. Eight percent of the Rhinoceros auklet population nests here. The probability of an oil spill contacting this area is estimated to be only two percent even after 30 days. therefore, oil spills due to the Proposal are not expected to significantly impact seabirds in the southern Santa Maria Basin.

However, should a spill occur near this colony during breeding season, impacts to the California seabird population would be low since only a small percentage of the California population nests in this area (Table IV.E.2.e-2).

The five offshore platforms and associated pipelines and facilities predicted for the basin should not significantly impact seabird colonies within the basin.

AREAS OUTSIDE THE PROPOSED SALE AREA

Central California. No large spills nor any development activities are expected to occur within Bodega, Santa Cruz or the northern Santa Maria Basins. Therefore, seabird impacts in Central California are expected to be insignificant.

There are no significant colonies in Bodega Basin. Within Santa Cruz Basin, should a tanker spill occur and contact feeding areas around the Farallon Islands or the islands themselves, impacts to California seabirds could be high to very high. (See discussion above and Table IV.E.2.e-1 and IV.E.2.e-2 for species present and sensitivity.) There are no significant seabird colonies within the northern Santa Maria Basin.

Southern California. One spill is expected to contact the 6-mile buffer zone surrounding the northern Channel Islands. The most likely area for contact is near San Miguel. Ashey storm petrels and Cassin's auklets nest on Castle Rock and Prince Islands nearby. Impacts would likely be moderate during nesting season (February-November) due to mortality of a large portion of the colonies (2-15% of the California population). In the unlikely event a spill contacts significant feeding areas for the brown pelican, impacts would likely be high during nesting season (February-October).

No significant impacts to seabirds are expected from the proposal in Southern California due to platforms, pipelines, or increased human noise and disruption.

ii. Conclusions: Impacts to the California seabird population are expected to be low to moderate (2-15% mortality of the California population of a species) due to an oil spill expected to contact the buffer zone around the northern Channel Islands. Impacts to seabirds in other areas of the state are expected to be very low from oil spills.

Impacts to California seabirds from noise and disruption are expected to be very low since no structures are expected to occur near significant colonies.

iii. Cumulative Impacts: Without the proposal or any further OCS hydrocarbon leases in Central California, seabirds will suffer impacts from several sources over the next 30 years. Sewage, increased tanker and recreational traffic, existing leases, and expanding population centers

along the coast may reduce seabird distribution and populations.

Some species are expected to suffer high impacts over the life of the proposal (15-30 percent mortality; recovery time one or two decades). If pollution levels remain constant or increase, many species may suffer low level (2-7 percent mortality; recovery time of several years) impacts from several sources and a general degradation of health is possible. Overall, most species are expected to maintain viable populations.

Eight oil spills are expected as a result of existing leases, foreign and Alaskan tankering. The Proposal is expected to contribute one oil spill to the cumulative impacts. The one spill may contribute a small to moderate amount to the impacts on seabirds depending on the size, trajectory and season of the spills.

f. Impact on Endangered and Threatened Species

i. Discussion: General discussions of marine birds and mammal impact agents and levels are in Sections IV.E.2.d and e. Endangered birds and mammals will be subjected to the same impact agents and levels discussed in these sections. The discussion below will point out behaviors and life histories that make the species susceptible to oil, noise, and disruption or dispersants. Those impacts not discussed below are considered potentially very low at this time.

Oil Spills. Table IV.E.2.f-1 gives the distribution of those species potentially significantly impacted. Table IV.E.2.f-2 lists the species discussed, their Endangered or Threatened status and potential, and expected impacts from oil spills. Impacts to a species from an oil spill would be the same whether a spill occurred in nearby waters or occurred at some distance and traveled to an area utilized by the species. Hereafter, either of these circumstances is referred to as "occur and contact habitat utilized by this species".

Expected impacts or events are those specifically predicted due to the Proposal. See Section IV.A.4.a for a discussion of expected oil spills. Likely or potential impacts are those that might occur as a result of an unpredicted event such as an oil spill. See Table IV.E.2.f-2 as an example. Definitions of impact levels are found in Appendix A.

Cleanup activities, should a spill occur, may be accompanied by an increase in noise and disruption from boats, aircraft, trucks, foot traffic and use of containment equipment. Dispersants may also be used. In some cases the impacts could be highly significant. Where applicable these impacts are discussed under the individual species below.

Noise and Disruption. Estuarine birds or rodents would be highly affected by noise and disruption in the vicinity of nests or burrows. However, OCS activities are expected to occur in these areas. Therefore no impacts to these animals are expected due to noise and disruption.

Gray whales and possibly humpbacks will be subjected to noise and disruption from boats, planes, platforms and seismic activities. Should changes in migratory routes and resources utilization occur due to increased activity from the

TABLE IV.E.2.f-1

ENDANGERED, THREATENED OR RARE SPECIES LOCATIONS

	Least Terns	California brown pelicans	Southern sea otter	gray whale	American peregrin falcon	bald eagles	Estuarine species
Bodega Basin							
Gualola River						w	
Salt Point State Park		a					
Russian River		a[2]				w	
Tomales Bluff		a				w	
Drakes Estero & Bay		a					
Bolinas Lagoon		a					
Rodeo Cove		a		f			
Santa Cruz Basin							
San Francisco Bay	b			f			ab[4,5,7]
Golden Gate State Park		a		f	f		
Half Moon Bay		a					
Pt. Sal			a				
Elkhorn Slough		a	ab				ab[4]
Salinas River		a	ab				
Santa Maria Basin							
Point Lobos		a	ab				
Morro Bay		a	ab		a[9]		ab[5,6]
Morro Bay State Park							ab[5,6]
Black Lake	b		ab				
Oso Flaco	b		ab				
Santa Maria River	b	b	a				
Purisima Point	b						
Santa Ynez River	b						
Northern Channel Islands							
Anacapa		b					

LEGEND
- a = adult concentrations
- b = nesting or reproductive sites
- f = possible feeding areas
- m = migratory concentrations
- w = overwintering areas

1. Several sites exist inside San Francisco Bay for the California clapper rail, California black rail, and salt marsh harvest mouse.
2. Concentrations of brown pelicans may include large numbers of sexually immature, nonbreeding or Mexican birds.
3. California clapper rail.
4 California black rail.
5. Morro Bay kangaroo rat.
6. Salt marsh harvest mouse.
7. Belding's savannah sparrow.
8. Salt marsh bird's beak.
9. Peregrin falcon nesting sites are not relased by Cal Fish and Game to protect the birds. See text.
10. Data was taken primarily from USFWS/BLM Ecological Inventory Maps. Additional information was supplied by Bob Mallette, Cal. Fish and Game.

TABLE IV.E.2.f-2

ENDANGERED SPECIES STATUS AND IMPACTS FROM OIL

	Status	Degree of Dispersal 1	Sensitivity to oiling 2	Likely Impacts in event of spill 3	Expected Impacts due to Proposal 4
Least Terns 7	FE	mo	hi	mo(ca)	vlo
California Brown Pelican 7	FE	lo	hi	hi(sp)	vlo
California peregrin falcon	FE	hi	hi	vlo(ca)	vlo
Bald eagle	FE	hi	hi	vlo(ca)	vlo
Southern sea otter	FT	mo	hi	mo-hi(sp)	vlo
Right whale	FE	hi	lo	vlo(sp)	vlo
Gray whale	FE	mo	lo	vlo(sp)	vlo
Other whales 5	FE	mo-hi	lo	vlo(sp)	vlo
Sea turtles 6	FE&T	hi	lo	vlo(sp)	vlo
California clapper rail	FE	mo	hi	mo-hi(sp)	vlo
California black rail	SE	mo	hi	mo-hi(sp)	vlo
Belding's savannah sparrow	SE	mo	hi	vlo	vlo
Morro Bay kangaroo rat	FE	mo	hi	mo-hi(sp)	vlo
Salt Marsh harvest mouse	FE	mo	hi	mo-hi(sp)	vlo

Legend

1. Degree of dispersal: low=single site, moderate=two to several sites with concentrations of animals, high=well dispersed without concentrations of animals.
2. Sensitivity of the animals should oiling occur. Low=temporary impairment of feeding behavior, moderate=impairment of breeding for a period of years, high=mortality likely.
3. Likely impacts are those impacts likely to the California population (ca)or species (sp) population if there is a large oil spill in the vicinity. The spill may be one that occurs nearby or one that occurs at some distance and travels to areas utilized by the Species. Impacts may be less than potential impacts due to inaccessibility of habitat or behavioral characteristics of species. (See Appendix A for a definition of impact levels.)
4. Expected impacts due to the proposal takes into account the number of spills expected to occur at the sites occupied by the species.
5. Other whales are the humpback, blue, fin, sei and sperm whales.
6. Sea turtle species are, green, Pacific Ridley, leatherback and loggerhead.
7. Impact level applies to breeding colonies only.

Proposal, very low impacts would be expected (see Section IV.E.2.d). Other whales and sea otters may experience some additional noise and disruption. Minimal impacts to these animals are expected, however, due to the low predicted levels of disruption in their vicinity.

Drilling effluents. Drilling muds or effluents are not considered potentially significant for any of the endangered spcies due to dilution factors.

SPECIES OF CONCERN

The following discussions consider the likely impacts should a spill occur and contact significant habitat for the species. Based on the most likely oil volume scenario, these impacts are not expected to occur since no oil spills are expected to occur and contact sensitive habitat or the species being considered is widely spaced or not sensitive to oil.

Least Terns. Least terns nest on sandy beaches, often in estuarine habitats. Juveniles are taught to feed in these quiet waters. Adults often feed at sea. if a large spill occurred during spring or early summer, nesting adults could become oiled while fishing. Oiled birds could contaminated young or eggs upon returning to the nest. Resulting mortality could be high. If an oil spill occurred near a least tern colony, the impacts to that colony could be locally high. A significant percent (15-30) of the colony adults and eggs or juveniles might die due to oiling. However, the colonies in the southern Santa Maria Basin are relatively small. Therefore, recovery time for the species should not be more than a few years. Likely impacts to the California population in the event a spill occurs and contacts significant habitat would be moderate (moderate reduction in population requiring several years for recovery).

California Brown Pelican. Pelicans are visual feeders and plunge into the water to obtain anchovies. Pelicans were observed diving into oiled waters for food about 40 percent of the time (Nero, 1982). Oiled birds and eggs have been found in the Gulf of Mexico. If there was a large spill in the vicinity of Anacapa Island West during nesting season, likely impacts to the species would be high (15-30 percent mortality) due to the concentration of birds. The colony would also be sensitive to noise and disruption at that time although awareness of that problem should prevent impacts. Pelicans are more evenly distributed throughout California during other times of the year and potential impacts to the species are low.

Southern Sea Otter. Impacts to the southern sea otter could range from very low to very high depending on the season and area of the spill. However, high mortality is likely. Impacts to the population, should a large spill occur and contact habitat utilized by the sea otter, would likely be moderate to high due to the death of 2-15 percent of the population. Should a very large spill or more than one spill occur in the sea otter range the likely impacts would be very high (15-30 percent mortality) and possibly put the population in jeopardy (greater than 30 percent mortality). See Section IV.E.2.d for more detailed analysis of impacts to the southern sea otter.

Whales. Likely impacts from an oil spill are very low. Should a right whale baleen plate become permanently fouled, the impacts would still be very low due to the death of a single animal which represents only 10 percent of the year's estimted production of right whales. Current data indicates

oiled gray whale baleen plates will clean themselves in a short period of time. Impacts to gray whales from noise and disruption are potentially very low due to changes in migratory routes. See Section IV.E.2.d for a more detailed analysis.

Guadalupe Fur Seal (Nominated Status Only). Significant impacts to the species are not likely due to the few animals present in the Channel Islands.

Sea Turtles. Four species of sea turtles occur off the California coast (see Table IV.E.2.f-1). None of these turtles lay eggs on the California coast. Sightings have been of an occasional single animal at sea. Likely impacts to the species are therefore considered very low.

American Peregrine Falcon. Peregrine falcon pairs occur along the Coast at 8-10 sites including Morro Rock. Most of the time peregrines feed by knocking down flying birds and catching them mid-air. Seabirds such as phalaropes are a common food for peregrines. However, one of the significant consequences of oiling seabirds is their loss of ability to fly. Therefore, it is doubtful peregrines will be fouled by oil since they would not have contact with oil. However, should oiling occur, the death of a pair of birds and loss of years clutch would have a low impact to the Central California population (recovery requiring a few years). One pair represents about 4 percent of the total breeding population. Peregrine nest sites are restricted information to protect the birds. Therefore, should a spill occur and prior to any cleanup efforts, contact should be made with the appropriate regional office of California Department of Fish and Game to determine if any nsting sites would be potentially impacted.

Bald Eagles. Bald eagles are generally carrion feeders and commonly eat salmon or dead fish washed ashore. Bald eagles winter northward from Napa County and breeding pairs are present on Santa Cataline Island. Juveniles are feeding offshore on Catalina Island. Introduction of breeding pairs to other channel islands is expected. One pair represents about 4 percent of the breeding population. Eagles could ingest fish contaminted with oil from a spill. However, likely impacts, in the event of a spill, are very low since it is doubtful mortality would occur due to ingestion. However, illness and loss of reproduciton for a year could occur.

Rails. California clapper rails and California black rails primarily use the upper reaches of estuaries for feeding and breeding. These areas are only seasonally subjected to high tides, therefore, they are usually inaccessible to spills. However, should a spill enter their habitat, impacts (mortality) would be high locally. Impacts to the sub-species would be moderate to high depending on the size of the colony involved.

Belding's Savannah Sparrow. These sparrows are entirely dependent on estuarine habitats. However, they rarely are found below the mean high tide line. Should a spill enter an estuary, impacts would likely be very low.

Morro Bay Kangaroo Rat. See rails for a discussion of impacts.

Salt Marsh Harvest Mouse. See rails for a discussion of impacts.

Terrestrial Species. Additional Terrestrial species should not be impacted. Most areas utilized by these species are protected by state and federal regulations. Consultation with USFWS and the State and local governments at the time of construction, should prevent impacts. In the event of an oil spill it will also be necessary to check with Cal Fish and Game and USFWS to determine if any sensitive species are located in areas where cleanup, beached bird or beached mammal crews might be working. Cleanup plans should contain provisions for avoiding sensitive species and habitats.

PROPOSED SALE AREA

Although one spill is expected to occur within the proposed sale area, no spills are expected to contact land. All oil sensitive species listed in Table IV.E.2-2 are widely dispersed in the proposed sale area or stay on, or fairly close to, land. Therefore, no endangered species in the proposed sale area are expected to experience significant impacts from oil or cleanup activities.

Oil spills. Should a large spill occur in habitat utilized by species, least terns would likely experience moderate impacts. Sea otter densities are less in the southern Santa Maria Basin than in other areas. Therefore, sea otters would likely experience moderate to high impacts due to mortality in the event of a large spill and high to very high impacts in the event of a very large spill or more than one spill. Estuarine species would be likely to experience moderate to high impacts. Other species should not experience significant impacts.

Noise and disruption. Least terns, gray whales, the southern sea otter, California black rail and Morro Bay kangaroo rat utilize the proposed sale area (see Table IV.E.2.f-1 and 2). None of these species is expected to experience significant impacts from noise and disruption due to the Proposal. (See Section IV.E.2.d for a more detailed discussion on whales.)

AREAS OUTSIDE THE PROPOSED SALE AREA

Central California. Since no spills due to the Proposal are predicted to occur in habitat used by endangered species outside the sale area, no impacts from oil or cleanup activities are expected for any endangered species in Bodega, Santa Cruz or northern Santa Maria Basins.

Oil spills. Should a spill occur in habitat used by least terns, the California population could experience moderate impacts. The sea otter would likely experience high to very high impacts or jeopardy due to mortality in a very large spill. (A tanker spill would probably be a very large spill.) Estuarine species could experience moderate to high impacts. Should a large spill enter San Francisco, one or more of the species would likely be impacted.

Southern California.

Oil spills. One spill is expected to contact the 6-mile buffer zone around the Northern Channel Islands within 30 days due to the Proposal. Should this occur during the brown pelican nesting season, the impacts could be high. However, several circumstances would need to be present: 1) nesting season,

2) spill contact in areas of significant feeding, 3) a large slick still present after 30 days. When coupled with the relatively low likelihood of a spill in this area (probably 0.26), no significant impacts are expected.

Noise and disruption.

Contingency plans need to consider ways of protecting the California brown pelicans on Anacapa Island from noise and disruption due to cleanup activities in the event of an oil spill.

ii. Conclusions: Impacts to all endangered species from oil spills are expected to be very low (less than 2 percent mortality) under the Proposal since no large spills are expected to occur and contact significant

habitat (probability less than 0.25) utilized by sensitive species. Noise and disruption are also expected to have very low impacts on endangered species.

In the event a large (greater than 1,000 bbl) spill occurs and contacts habitat utilized by a species, impacts would likely be as follows: least terns - moderate (7-15 percent mortality to the Central California population); brown pelicans - high (15-30 percent mortality to the California population). Successive spills impacting the same species would increase impacts at least one level. Depending on the size and location of a spill, impacts to the southern sea otter could range from very low to very high. In the event of a 5000 bbl spill, a high (7-15 percent mortality) impact would be most expected (probability greater than 0.25). If the southern sea otter population is reduced by more than 25 percent, jeopard to the population could result. This is quite possible in the event of a very large spill within the sea otter range.

Impacts likely to terrestrial birds and mammals, in the event of a large spill occurs and contacts sensitive habitat, range from very low to very high due to behavioral and habitat considerations. Likely impacts are as follows: peregrine falcon - low for the California population; bald eagle - very low for the California population; estuarine species (clapper rails and salt-marsh harvest mouse) - high for species or sub-species. Impacts would be due to a reduction in population size due to direct mortality or loss of reproductive capacity. Successive spills could increase impact levels.

iii. Cumulative: Without the proposal or any further OCS hydrocarbon activities in California, endangered species will suffer impacts from several sources over the next 25 years. Sewage disposal, increased tanker and recreational traffic, expanding population centers along the coast, changing climatic conditions or other natural changes, and existing OCS leases may cause changes in species abundance and distributions. Some species such as least terns, peregrine falcons and bald eagles seem to be recovering. Their biology is reasonably well understood and expected recovery should continue. Other species such as the rails are secretive animals and little of their habitat remains. Their future is much more tenuous. The status of the southern sea otter is also in question and oil spills form oil tankering are a serious threat. Overall, it is expected some species will increase in numbers and distributions. Others face extinction over the next 25 years.

Eight oil spills are expected as a result of existing leases, foreign and Alaskan tankering. The Proposal is expected to contribute one oil spill to

the cumulative impacts. The one spill, if it occurs, may contribute a small to large amount to impacts on endangered and threatened species, depending on the size, trajectory and season of the spill.

The 30 platforms expected in the proposed sale area will triple the number of platforms in Central California from existing State and Federal leases. If gray whales are more sensitive to platform noise than is expected, the impacts could cause significant changes in migration patterns and possibly other aspects of population dynamics.

g. Impact on Estuaries and Wetlands

i. Discussion: Estuaries and wetlands are critical areas of high productivity and contain distinct assemblages of fish, birds, invertebrates, and plants. The estuarine intertidal and subtidal benthic community plays an important role in the overall ecology of an estuary. Any event which destroys a large proportion of this community in a bay will have a significant effect on other communities in the bay, such as fishes, birds, and even terrestrial mammals which depend upon salt marshes for feeding. Wetlands are important habitats for many species during at least one stage in their life cycle; examples are the California halibut, the endangered least tern, and California black and clapper rails. Geographic isolation has prevented easy genetic mixing for some species. Repopulation or restoration, once a wetland is destroyed, is slow or impossible (see Sections III.A.6, IV.E.1.a and 2.d).

From San Francisco Bay and south, there are only a couple of sizeable estuaries, (Tables III.B.8-1 and 2), but these estuaries are important to the area.

Proposal-related factors potentially affecting wetlands are oil spills and possible onshore construction. The activities associated with offshore drilling and platforms are not expected to cause impacts on estuaries and wetlands.

Should an oil spill occur and contact an estuary, high impacts could occur. The lack of substantial estuarine wetland habitat (except for Elkhorn Slough and Morro Bay) to the south of San Francisco Bay, is a cause for concern because there are so few areas to act as a source of brood stock or buffer against significant impacts to the adjacent ocean areas. The ocean areas are partly dependent upon estuaries for biological and nutrient resources sources.

Oil Spills. Although most historical data on the impacts of oil spills on estuaries comes from outside central-northern California, the habitats are similar enough to predict that the severe impacts caused by crude oil in estuaries in other areas (Bender, et al., 1977) would also occur in California. In the event of a large spill which completely covers the surface and the tidal flats of an estuary, and remains for several days, destruction could be manifested for over 10 years. Some species within the estuary, if endemic, may be permanently eliminated. These are high (a significant interference with ecological relationships lasting for two or more years) to very high (cause a species or assemblage to become endangered or extinct) impacts (Appendix A). Artificial restocking of the habitat may also be

necessary. More detailed examinations of the impacts on estuaries and wetlands can be found in BLM (1975, 1979, and 1980).

Short Versus Long Exposure to Oil. Studies on the important estuarine salt marsh communities indicate it is necessary to have large quantities of oil covering the area long enough for oil to penetrate into the sediment before high mortalities to the entire salt marsh community occur. Baker (1971a) reported most marsh seed plants recovered from light single dose coverage by crude oil although leaves were killed, eliminating primary productivity until the following season. The loss of cover or food source supplied by the leaves could cause high impacts to species dependent upon them. Evidence has also been presented which indicates actual growth stimulation of salt marsh plants due to light oiling (Baker, 1971b). Causes for this phenomenon primarily involve greater release of nutrients from killed organisms or from oil itself.

Baker (1971a) reported that heavy pollution was more damaging when there was sufficient oil to soak into the ground around the base of plants and kill their growing points, causing plant mortality. Penetration of oil into the substratus has direct effects by spreading around root systems and reducing normal bacterial activity or oxygen content. This smothers the shoots of plants such as Spartina which pass oxygen into the soil via their roots. A single heavy oiling could cause such mortality, since a significant amount of oil would penetrate into the sediment or left as residue during the high tide period. Depending on current or wind velocities and wave energy, oil could be redeposited on the salt marsh during the following low tide period in a cyclic process allowing more oil to penetrate each cycle.

Once in the sediments of an estuary, oil can remain for years. The residence time and resulting impact depends upon the wave energy, type of substrate and vegetative cover present, and type of oil. when substrate is heavily oiled, erosion can be increased 24 times. Population densities may continue to decrease for several years before recovery commences. Vandermeulen (1977) reported that some of the intermediate compounds during oil breakdown were more toxic than the original. It required 2 years for Spartina to begin recovery at Chedabucto Bay from a Bunker C spill (Vandermeulen, (1977). Refined oil is typically more toxic than crude, so the recovery rate reported by Vandermeulen may be longer than can be expected from a crude oil spill.

Some species in salt marshes and all seedlings salt marsh seed plants are very susceptible to oil (Baker, 1970). Plants having shallow roots, with no food reserves are quickly killed and cannot recover except from new seeds. Pickleweed (Salicornia spp.) is such a very susceptible species. The California species occurs at the upper reaches of high tide and is not always covered at high tide, and would not be oiled except during very high tides. Pickleweed is an important component of the endangered black and clapper rails. Loss of the pickleweed habitat could have serious effects on the rails of an estuary (see Section IV.E.2.f).

Recovery from an Oil Spill. Predicting the recovery period from prolonged oil coverage of an estuary is complicated by how long the oil in the substrate remains toxic, thereby preventing repopulation to commence. Recovery from a severe spill, if most species have been eliminated, could involve a successional sequence where preclimax species occupy a habitat, temporarily outcompeting the climax species. This could cause recovery to take longer than ordinarily would be required.

According to Shenton (1973), recovery of a mud flat would require over 10 years. The important salt marsh would be effectively killed for 6 months to a year from a small coverage, but completely killed for an unknown time (until the sediment becomes nontoxic enough to sustain seed germination and sexual maturation) if the coverage is heavy and lasts several days.

The impacts on plankton will vary from low (insignificant interference with ecological relationships lasting less than a year) if only a small portion of the water surface were oiled, to high, if the entire surface were covered for several tide cycles. The larvae of benthic or fish species can be decreased so subsequent years will have small populations of the year-class which was oiled.

Oil Diversion/Containment Operations. Many variables influence the success of oil diversion/containment operations. The conditions that make boom equipment ineffective are only known in a general way. Our assumptions for the physical conditions under which diversion equipment is no longer effective are: water current velocity greater than 1.25 knots (2.11 ft/sec), surface wind velocity greater than 25 mph, or wave height 6 to 8 feet or greater (see Section III.B.2).

According to Johnson (1972), no estuaries have a mean opening channel velocity greater than 1.25 knots. Several estuaries may have velocities above the critical value during certain periods of the tidal cycle. Brenna Malouf of Grover City (personal communication) cites a Coast Guard representative (Mr. Sutherland) as reporting that current velocities of over 4 knots are typical of the channel entrance into Morro Bay. Summer wind velocities rarely reach 30 knots in Central California (Winsler and Kelley, 1977).

Since the openings to estuaries and the protective ability of oil containment-diversion equipment is highly variable, it is necessary to generalize when discussing potential impacts of oil spills on estuarine habitats. With the use of conventional containment-diversion techniques, it is assumed that estuary openings of greater than 100 meters are extremely difficult to protect once oil approaches the mouth. Table IV.E.9-1 shows there are 5 estuaries which have "normal" openings greater than 100 meters. During the winter, when a combination of flooding and storms tend to cause the widest openings of the year, there are nine estuaries in Central California which have openings greater than 100 meters. San Francisco Bay and the Pajaro River have "normal" entrances around 300 meters or larger.

The factor which causes the greatest problem in the control of a spill at an entrance is wave height. The nearshore data is limited, but deep water wave height data (tabulated at 1 degree intervals, 140 observations minimum per interval) is valuable. This is true particularly for diversion considerations, since it is most desirable to divert an oil slick before it has reached too close to estuary entrances. The percentage of observations of waves, 7-9 feet or greater at the most shoreward 1 degree coastal latitude gradients, together with estuaries having "normal" openings greater than 100 meters, are shown in Table IV.E.9-1 (U.S. Naval Weather Detachment, 1976). The 7-9 feet wave heights were used because the data were presented in those increments. These increments are less conservative than the 5-6 feet wave height used in Sale No. 53 (BLM, 1980).

These data indicate that larger waves are more frequent during the winter, but the difference is inconsistent and ranges from about 2 to 15 percent. There is a slight gradient reduction in the frequency of large waves as one moves south.

Oil containment equipment will be effective approximately 60 percent of the time around San Francisco Bay during both winter and summer. South of San Francisco Bay, oil containment equipment will be effective 64 to 78 percent of the time (average 71 percent) during the winter, and 72 to 90 percent of the time (average 79.7) during the summer.

Dispersants may be more effective at preventing an oil spill from entering an estuary, particularly if applied to the spill before it nears the estuary opening. The use of dispersants, particularly in a timely manner, is not guaranteed; however, a rigorous approval process is required before their use is allowed (see Section IV.B.2).

The extent of impacts resulting from chronic oil pollution are not well known. However, it is doubtful that an estuary will receive significantly prolonged exposure from chronic effluents or the several small spills to cause significant impacts. The distance of three or more miles from platforms to the entrance would allow dilution and weathering of the small amounts of oil that might remain to reach shore to both become less toxic and less concentrated. Variable currents and wind patterns would prevent most estuaries from receiving chronic oil pollution consistently. Impacts above low are not expected to occur.

In discussion the impacts on estuaries from oil spills, we will emphasize the estuaries that have openings of 100 meters (Table III.B.8-3).

Onshore construction activities which involve any part of an estuary would cause high ecological loss to the part of the wetland involved. However, pipelines and platforms are not expected in the vicinity of the wetlands, and consequently, the likelihood of impacts are very low. For this reason, onshore construction impacts are not discussed in the basin by basin analysis.

PROPOSED SALE AREA

Oil Spills. Since no spills are expected to enter an estuary within the Proposed Sale Area, significant impacts are not expected.

Estuaries within the proposed sale area having openings of 100 meters or greater, are Morro Bay and San Luis Obispo Creek.

Although one oil spill is predicted for the Santa Maria Basin, the probability of it reaching the entrances to one estuary is very low. Since no spills are expected to enter an estuary in this basin, significant impacts to estuaries are not expected.

If a large oil spill were to enter an estuary, the severity of impacts depends upon the areal extent of coverage and length of time the estuary remains covered by the oil. If the oil covers a significant portion of the estuary and remains for several tidal cycles, the impact will be high or possible very high, depending on the distribution of the particular species in other

estuaries along the coast. A spill covering a smaller portion of the estuary or one covering a significant portion of the estuary, but remaining for only a couple of tidal cycles, will probably cause a moderate impact. During a moderate impact a few species may experience a slight stimulation of growth (Baker 1971b).

The proposed sale area has only one major estuary, Morro Bay. This bay, however, is a highly productive and important bay and undoubtedly contributes to the overall ecology of the coastal ecology of Santa Maria Basin. A high to very high impact to Morro Bay may cause a moderate regional impact to the coastal ecology of the entire proposed sale area, but the regional impact

may just as likely be low. Other factors, such as upwelling, probably become relatively more important to coastal ecology than further north. Conversely, a high impact to the single important estuary in the area may be extremely detrimental to the area since there are few other sources for coastal species that utilize estuaries during part of their life cycle.

AREAS OUTSIDE THE PROPOSED SALE AREA

Significant impacts are not expected since no large spills are predicted for north of the Proposed Sale Area.

Central California. Estuaries within Central California having openings of 100 meters or greater are Bodega Bay, San Antonio, Drakes-Limantour Estero, Bolinas Lagoon, San Francisco bay, Rescadero Marsh, Pajarro River/Watsonville Slough and Elkhorn Slough.

Since no large spills are predicted for areas north of the Sale Area, significant impacts to estuaries are not expected.

However, if a large spill were to occur due to tankering and to enter an estuary, the impacts would be similar to those discussed above in the proposed sale area.

The regional impact to the coastal areas of Central California resulting from a high or severe impact to one of its major estuaries may be moderate. Estuaries are apparently important to the coastal areas in this region, serving as nursery or breeding areas to species that contribute to overall ecology of the coastal areas.

Estuaries also contribute to the nutrient content of coastal areas. A high impact to a major estuary could cause an abnormal amount of enrichment to the coastal region through decay of estuarine species killed by the spill. The regional impact from this aspect of estuarine impacts, however, should not be as important as the mortality of estuarine species.

San Francisco Bay is a special case, and therefore, the prediction of impacts for estuaries would not be similar. It is doubtful that San Francisco Bay will ever have a significant portion covered by oil. High or moderate impacts will most probably be limited to certain habitats within the bay. Much of San Francisco Bay is already greatly altered by many human disturbances, including oil pollution from land runoff. Other portions of the bay still suport diverse and viable assemblages. A large oil slick could exert a sinergystic effect with other pollutants and cause a greater impact than

either would alone. Conversely, the oil slick could move to an area already greatly disturbed and cause little additional impact to the estuarine communities than have already occurred for many years.

South of San Francisco, the size of estuaries and resulting area of habitat (salt marshes, mud flats, eel grass beds, open water, etc.) decreases. The importance of estuaries, as a result, to the offshore ecology apparently is less than in the basins further north. There still are many important smaller

estuaries in this basin and San Francisco Bay no doubt plays an important part in the ecology of most of the Santa Cruz Basin. Regional impacts to this basin resulting form a high impact to a couple of the more important estuaries could cause a moderate regional impact.

Southern California. Large spills are not predicted to reach the coast in Southern California. Therefore, impacts to estuaries are not expected.

The severity of impacts of these estuaries, if hit by a large oil spill, for an individual estuary and on a regional basis resulting from a large oil spill are similar to those discussed under the proposed sale area.

ii. Conclusions. Impacts to Central California estuaries and wetlands are not expected to occur due to the proposed action. However, if a large oil spill occurred and entered an estuary, impacts could be high (a significant interference with ecological relationships lasting two or more years) to very high (cause an assemblage or species to become endangered or extinct).

iii. Cumulative Impacts. According to the oil spill model, there are an expected 3 large oil spills from oil development and an additional 5 large spills from tanker accidents. These spills increase the probability that at least one large spill would occur and enter an estuary causing a high to very high impact to the estuary.

Major estuaries having probabilities of 25 percent or greater of a spill occurring and entering within 3, 10 and 30 days are shown below:

Estuary	3, 10, 30 Day Hit Probability (%)
Bolinas Lagoon	46, 52, 53
Drakes-Limantour Estero	11, 41, 45
San Francisco Bay	36, 44, 44

Based upon this information, we can expect a high to very high impact on Drakes-Limantour Estero and Bolinas Lagoon in Bodega Basin with moderate regional impacts. San Francisco Bay (whose entrance is at the beginning of Santa Cruz Basin) may sustain high to moderate impacts in certain areas, but regional basin impacts will probably be low.

The estuaries outside the sale area in Southern California that have 10 day hit probabilities of over 25 percent include Goleta Slough, Carpinteria Marsh and Santa Clara River. The Santa Ynez River has a 30 day hit probability of 25 percent. All of them have small openings, however, and the chance of oil entering them is small.

An unknown number of oil spills is expected to occur from development of oil and gas resources in State tidelands and other vessel traffic. This activity should raise the likelihood of oil spill impacts.

Cumulative impacts in the Santa Maria Basin on estuaries could come from vessel accidents.

h. Impact to Areas of Special Concern

i. Discussion: The definitions for the State-designated areas of special concern are discussed more fully in Section III.B.8. These areas include marine life refuges, ecological reserves, areas of special biological significance (ASBS) and underwater parks and are designed to protect intertidal and shallow water subtidal inhabitants. Additionally, the California Sea Otter Marine Life Refuge in Central California was established to protect the sea otter populations.

Oil spills would cause impacts on the shallow subtidal and intertidal areas to the extent that is discussed in Section IV.E.2.a and b. The impacts from a large spill could be low (an insignificant interference with ecological relationships lasting less than a year) for the shallow subtidal areas and low to moderate (a significant interference with ecological relationships lasting for less than 2 years) for the intertidal areas. This conclusion is primarily based upon the large Santa Barbara oil spill (Straughn, 1970; Foster, 1974 and Foster, et al., 1971) where the impact to the intertidal was moderate.

Potential impacts to estuaries are high (significant interference with ecological relationships lasting two or more years) (Section IV.E.2-g).

Although most of the areas of special concern involve intertidal or subtidal benthic communities, some of the areas are important habitats (Farallon Islands, Ano Nuevo and Northern Channel Islands). With the exception of the sea otter refuge, none of the ASBSs are considered to contain populations significant to seabird or mammal species on a regional basis. That is, impacts to the California populations would not be significant. See Sections IV.E.2.d, e and f for a discussion of impacts to these species. Impacts to sea otters, from a large spill, however, could be expected to be high. (Moderate to major reduction in the size of the California population requiring several years to decades for recovery. A high impact is the level which would be expected to occur every 30-40 years due to natural environmental conditions.) (Section IV.E.2.d and f.)

Impacts to the special designated areas could also come from pipelines. However, with the high degree of concern placed upon these areas by the State of California, it is highly unlikely that pipelines would be allowed to transverse them. Impacts associated with drill and platform construction are not expected to occur since minimum distance of 3 miles away from these activities would be far away to tamper impacts.

PROPOSED SALE AREA

The Areas of Biological Significance (ASBS) of the Proposed Sale Area is the Julia Pfeiffer Burns Underwater Park.

Although one large oil spill is predicted for the proposed sale area, signi-

ficant impacts from oil spills are not expected because the spill is not expected to reach shore. However, if a large oil spill were to contact the Julia Pfeiffer Burns Underwater Park, the most likely impact to its biological resources would be low locally and regionally.

AREAS OUTSIDE THE PROPOSED SALE AREA

Central California. Areas of Biological Significance are listed below:

Point Reyes Headland Reserve	Farallon Islands
Duxbury Reef Reserve	Bird Rock
James V. Fitzgerald Marine Reserve	Double Point
Ano Nuevo Point and Island	Carmel Bay
Pacific Grove and Hopkins Refuges	Sea Otter Refuge
Point Lobos Ecological Reserve	

Since no large oil spills are predicted for Bodega Basin, significant impacts from oil spills are not expected. However, if a large oil spill were to contact an area of special concern, the most likely impact to the intertidal habitats would be low (Farallon Islands, Point Reyes, Bird Rock, Double Point and Carmel Bay) and moderate for all other areas. Impacts to Duxbury Reef may be high (a significant interference with ecological relationships lasting two or more years). (Section IV.E.2.a.)

Southern California. Since no large oil spills are predicted to reach an area of special concern in Southern California, significants impacts from oil spills are not expected.

However, if a large oil spill would contact an area of special concern, the most likely impact to rocky intertidal communities is moderate locally and low regionally (Section IV.E.2.h).

ii. Conclusions. Impacts to the areas of special concern in Central California are not expected to occur due to the proposed action. However, if a large oil spill occurred and contacted an area of special concern impacts to sensitive intertidal areas could be moderate (a significant interference with ecological relationships lasting less than 2 years) to high (a significant interference with ecological relationships lasting two or more years).

iii. Cumulative Impacts. According to the oil spill model, there are an expected 3 large oil spills from oil development and 5 additional large spills from tanker accidents. These spills increase the probability that at least one large spill will occur and contact an area of special concern.

The southern part of Point Reyes Headland Reserve, Duxbury Reef Reserve and James V. Fitzgerald Marine Reserve have 3-day occurrence and hit probabilities of 46 and 36 percent. The remaining portion of Point Reyes Headland Reserve has a 31 and 45 percent 10 and 30 day occurrence and hit probability.

In Southern California, the northern shores of San Miguel, Santa Rosa, and Santa Cruz Islands have 10 and 30 day occurrence and hit probabilities ranging from 37 to 55 percent. The northern shores of San Miguel Island is the habitat for several sensitive sea birds while Santa Rosa Island's northern shore contains a potentially sensitive intertidal area (Sections IV.E.2 and

6).

The potential impacts to these areas would be the same as those discussed in the basin summaries.

i. Impact on Point Reyes/Marine Sanctuaries

i. Discussion: The Point Reyes Wilderness Area/National Seashore essentially comprise the Point Reyes Peninsula from the mouth of Tomales Bay to the Point Reyes Gird Observatory a few mils north of Balunas Point (see Section III.B.g). This area, which contains unaltered intertidal areas and the estuary Drakes Limantour Estero, has similar boundaries to the marine sanctuary.

The Point Reyes/Farallon Islands Marine Sanctuary contains the largest breeding colony of seabirds in California and is an important pinniped rookery. The waters of the area are highly productive and are an important foraging area for the birds and pinnipeds.

In Southern California, the Channel Island National Marine Sanctuary in the Santa Barbara Channel (Section III.B.7) contains highly productive waters and bottom communities utilized for feeding by the important pinnipeds and birds which nest or breed in the Sanctuary. In addition, Monterey Bay and the surrounding area are proposed as a Marine Sanctuary and Cordell Bank, off San Francisco, has been nominated for sanctuary status.

Impacts to these species and communities from oil and gas operations will be the same as those discussed under the appropriate biological resources in Section IV. The biological resources which would be impacted by oil spills, either from smothering, oil toxicity, or fouling include seabirds, pinnipeds, estuarine communities, intertidal and subtidal benthic organisms.

PROPOSED SALE AREA

No sanctuaries exist within the Proposed Sale Area.

AREAS OUTSIDE THE PROPOSED SALE AREA

Central California. No spills are expected to occur and contact sensitive areas in Central California. However, should a tanker spill occur, the impacts are discussed below.

Central-northern California pinnipeds should experience low impacts should a single large to very large spill from tankering contact the Farallon Islands. However, due to large concentrations of sensitive seabird species, the California population of seabirds could experience high to very high impacts (15 to 30 percent mortality to the California population of several species with recovery expected to take several years to decades). See Appendix A for a further definition of impacts and Section IV.E.2.d and e for impacts to individual species.

Impacts to intertidal communities on the Farallon Islands and Point Reyes would be low to moderate (insignificant to significant interference with ecological relationships lasting less than two years). The Drakes-Limantour Estero may

experience high (significant interference with ecological relationships for over 2 years) to very high (cause an assemblage or species to become endangered or extinct) regional impacts to these resources should be moderate. (See Section IV.E.f.)

The nominated Cordell Banks Marine Sanctuary would not experience significant impacts from an oil spill.

Impacts on the proposed Monterey Bay and surrounding area marine sanctuary are impossible to predict at this time because the sanctuary and exact resources of concern have not been defined. The most we can predict is that impacts would be similar to a variety of biological resources described in Section IV.E.2.

Southern California. Impacts to the Channel Islands Marine Sanctuary would primarily be due to oil spills. One large spill is predicted to occur and contact the 6-mile buffer zone which is part of the Marine Sanctuary. No spills are expected to contact the Islands themselves. Expected impacts to northern fur seals could be high during pupping season (mortality of 25 percent of California population requiring several years to one or two decades for recovery). Impacts to other pinnipeds in the Sanctuary range from very low to low (less than 2 percent reduction in the population to as high as 7 percent reduction; recovery requiring a few months to several years) due to a single spill. See Section IV.E.2.d for more detailed analysis.

The entire population of the California brown pelican nests on Anacapa Island. Should the spill occur during the breeding season and contact the Island or surrounding feeding grounds, the impacts could be high (mortality of 25 percent of the population requiring years to one or two decades for recovery). Impacts to Cassin's auklets and Ashey Storm Petrels could be low during the breeding season (2-7 percent mortality; recovery one to several years).

Expected impacts to rocky intertidal communities due to a spill would be moderate, although high impacts are possible on the northern shore of Santa Rosa Island and Santa Barbara Island. Regionally these impacts would be low.

ii. Conclusions: Impacts to the Point Reyes/Farallon Islands Marine Sanctuary and Point Reyes Wilderness Area/National Seashore are not expected to occur due to the proposed action. However, if a large oil spill reaches the marine sanctuary, moderate (moderate change in distribution or size of the affected population. Recovery is expected to require several years) to high (moderate to major change in distribution or size of the affected population. Recovery is expected to require several years to decades) local and regional impacts may occur to several seabird species.

The Drakes-Limantour Estero within Point Reyes Wilderness Area may experience high impacts (significant interference with ecological relationships lasting for two or more years). The Channel Islands National Marine Sanctuary is expected to experience impacts from an oil spill. Northern fur seals are expected to experience high impacts (25 percent mortality to the California population) if a spill occurs during pupping or breeding season.
If a large oil spill reaches brown pelican feeding grounds, impacts to the brown pelican may be high (mortality of 25 percent of the California brown pelican).

iii. Cumulative Impacts: Due primarily to oil imports, the oil spill model predicts a probability of 78 percent of a spill occurring and reaching the Point Reyes/Farallon Island National Marine Sanctuary within 3 days of the spill, the 10 and 30 days occurrence and hit probabilities are 80 and 81 percent, respectively. The land segments which the more sensitive species occupy have a 36 and 47 percent 3-day oil spill occurrence and hit probability. Both the land segments and waters of the marine sanctuary are expected to be impacted by an oil spill. The impacts to the sanctuary biological resources should be similar to those discussed above, except that repeated spills would elevate the expected impacts at least one level.

The Channel Islands National Marine Sanctuary has a 3, 10, and 30 day occurrence and hit probability of 80, 94 and 96 percent, respectively, and is consequently expected to be impacted. The impacts from a single oil spill hit will be the same as described above.

The number of spills expected to occur and contact the Channel Islands National Marine Sanctuary are two, within 3 days of the spill, and 3 within 10 and 30 days. Multiple spills, contacting the same area would increase the likelihood of high ecological impacts to all biological resources discussed above (see Sections IV.E.4, 7, 8, and 10).

3. Socioeconomic Environment

a. Coastal Economy

i. Discussion: OCS activity from Proposed Sale No. 73 would result in changes in employment and earnings in Central California. These changes would impact local onshore areas depending upon the location of OCS facilities and the place of residence of new workers.

This section will identify the changes in employment and earnings and the effect on local employment which would result from the proposal. The following indicators will be used in the impact analysis and conclusions:

Employment associated with the sale is identified as direct, indirect, and the induced. The sum of the direct, the indirect, and the induced employment makes up the change in total employment associated with the sale. From the total employment, the local and permanent employment were estimated.

Direct employment consists of those workers involved in oil and gas exploration, development, production and other OCS-related activities. Indirect employment resulting from the primary oil and gas extraction activities occurs in secondary (pipeline layers, marine mechanics, etc.) industries. Induced employment is tertiary (store clerks, waiters, etc.) employment resulting from both direct and indirect employment which occurs in non-oil and gas industries. Local employment is the estimated number of jobs expected to be filled from local labor pools. Permanent employment is the number of jobs associated with OCS oil and gas production, support facilities and related maintenance needs after exploration, development and installation of platforms and pipelines have been completed.

During the exploration and development phases, many jobs would be filled by outside labor already under contract with oil companies. Normally, oil companies operate on an extended shift of 7 days on with the following 7 days off or 28 days on and the following 28 days off. Workers usually remain onboard the exploratory vessel or on the platform during their extended shift and return to their place of residence (outside the sale area) on their days off. The use of this arrangement will minimize the impacts on local public facilities.

Local employment is expected to be used to the maximum extent possible. It is assumed that about 25 to 50 percent of the OCS-created jobs would be filled by local residents at each phase of OCS activity. Local labor may be used in both temporary and permanent positions.

Historical data on employment and earnings by industry were obtained from the California State Employment Development Department and the U.S. Water Resources Council, OBERS Projections. From these figures projections were made to develop a base case scenario without the sale. Labor force base case projections were made to the year 2010 and base case projections on earnings to the year 2020.

Direct employment projections with the proposal are based on the estimated exploration, development, production, platforms, pipelines, and support facilities in accordance with the Most Likely Find Scenario. Projections with the proposal were developed for the 1983-2007 period. An industry- and region-specific gross output multiplier system was used to project the changes in earnings and the indirect/induced employment expected to result from the proposal.

The Regional Industrial Multiplier System (RIMS) used in support of the economic analysis in this section was developed by the Bureau of Economic Anaylsis, U.S. Department of Commerce. The total regional economic effect of Proposed Sale No. 73 is composed of an initial impact and a secondary impact. RIMS requires that the initial change introduced into the economy because of the sale be defined in terms of an initial change in the final demand of a set of industries. The secondary impact is estimated using the industry- and region-specific multipliers. The product of the initial change and the multiplier provides an estimate of the change in total gross output. The sum of the changes in each affected category represents the total regional impact from the sale (Fernandez, 1983). The following analysis of impacts from Proposed Sale No. 73 consists of a discussion of impacts from development of Alternative 1.

The peak year (1990) employment gain expected from development in the Santa Maria Basin is estimated at 1,405, a 0.27 percent increase over the base. The change in permanent employment would be 487, a 0.07 percent increase. Local employment during the peak year would be 466, a 0.09 percent increase. The estimated change in permanent local employment is 222, a 0.03 percent increase. Table II.C.1-1 provides information on employment by decade between 1980 and 2010. Impacts on employment would be less than 1 percent increase over the base, a very low impact on the study area. Tables IV.E.3.a-1 and 2 provide additional information on employment impacts from the proposal.

The change in earnings as a result of development in the Santa Maria Basin is estimated at $90.9 million, an increase of 0.60 percent over the base. This

TABLE IV.E.3.a-1

DIRECT AND TOTAL EMPLOYMENT DUE TO PROPOSED SALE NO. 73
(MOST LIKELY SCENARIO)

Year		Year	
1983a	109	1990a	812
1983b	190	1990b	1,405
1984a	254	1991a	750
1984b	444	1991b	1,302
1985a	254	1992a	300
1985b	444	1992b	487
1988a	425	2007a	300
1988b	729	2007b	487
1989a	725		
1989b	1,251		

TABLE IV.E.3.a-2

YEARLY LOCAL EMPLOYMENT
(MOST LIKELY SCENARIO)

Year	Santa Maria Basin
1983	61
1984	143
1985	143
1988	252
1989	422
1990	466
1991	425
1992	222
2007	222
Total Local	5,544
Total Employment	13,808

Source: MMS, Pacific OCS Region Estimates, 1982.

represents a very low impact on the study area (an increase of less than 1 percent over the base). Table IV.E.3.a-3 provides additional information on changes in earnings as a result of Proposed Sale No. 73.

ii. Conclusions: OCS activity from Proposed Sale No. 73 would have an insignificant stimulating effect on employment and the regional economy. Total employment impacts from Alternative 1 are expected to be very low (an increase of less than 1 percent over the base). Changes in earnings for the sale area would be very low (an increase of less than 1 percent over the base).

iii. Cumulative Impacts: As a result of offshore oil and gas development from State (575 jobs) and Federal (2,121 jobs) leasing activities and activity from other ongoing non-OCS related projects in the region, the coastal economy is expected to experience an increase in employment. This would result in a general expansion of the economy in affected areas. However, since these gains are expected to be low (a 1 to 3 percent increase over the base) no significant change in the socioeconomic character of the region would be realized. Furthermore, through the local coastal programs (LCPs) communities along the coast are able to manage residential and industrial development, as well as the use of land resources in their area. Consequently, affected communities possess the ability of controlling the extent and location of onshore economic growth that could result from OCS development along the Central California coast.

b. Demography

i. Discussion: The impacts on demography have been evaluated the terms of the change in population because population change is the greatest impact agent, and population estimates are the most readily available of demographic projections. Other demographic parameters (racial characteristics, education, age, family size, etc.) are expected to become more like the national average as population increases. Some demographic characteristics that are expected to move toward the national average are presented in Table III.C.2-2.

The determination of the permanent increase in population was done by assuming that for each job filled by an immigrant worker, population would increase by 2.75 people, or for every 100 new jobs, population would grow by 275 people. "Economic Impacts of Proposed OCS Sale No. 73 Offshore Central California" (Fernandez, 1983) explains the procedure used to determine the changes in population resulting from Proposed OCS Sale No. 73.

During the peak year of development (1990), population is expected to increase by 1,403 people in the study area, or an increase of 0.15 percent of the 1980 population. The permanent increase in population is expected to be an additional 729 people or an increase of 0.08 percent over the 1980 population of 932,590. If the entire population increase were to settle in any one county of the Central California Coast, the population increase would still be less than 1 percent of the 1980 population.

No community in the study area is expected to suffer any significant adverse impact as a result of OCS development, related to Proposed Sale No. 73. The boom and bust syndrome often accompanying onshore development is not expected to occur with offshore development, because the majority of temporary labor

TABLE IV.E.3.a-3

CHANGES IN SELECTED ECONOMIC COMPONENTS OVER THE BASE
(MOST LIKELY SCENARIO)

Basin	Wholesale/Retail	Services	Housing	Transportation	Earings
Santa Maria	$41,943,495	12,671,843	17,047,995	3,278,674	90,942,007
	1.8	.90	2.4	.40	.60

Source: MMS, Pacific OCS Region Estimates, 1982.

is housed offshore, either on platforms or drill ships. The temporary population increase which is not accommodated by offshore living arrangements are expected to reside in motels, hotels, and other temporary housing.

The level of changes expected from this alternative are very small and may be included in the projection of changes in population, prepared by the State of California. All population related impacts, however, were assumed to be over and above those that would occur in the future without the proposal. Table IV.F.3-1 shows the expected change in population without the proposal.

ii. Conclusion: The increase in population is expected to be 0.12 percent of the population base in the peak year (1990). The permanent increase in population as a result of this alternative is expected to be 0.06 percent of the 1990 population. Increases in population of the magnitude expected are considered to be insignificant.

iii. Cumulative Impacts: Cumulative impacts of this proposal, other projects, and the general population increase expected by the State of California will result in an additional 730,510 people between the years 1980 and 2020 in the study area. OCS development is expected to account for 5,832 or 0.80 percent of the increase in population. Other projects, such as State tideland leasing (1,300), expansion of Vandenberg Air Force Base (8,500), and the Point Conception LNG facility (9,263) are expected to add 19,063 people to the study area. The contribution to population growth from these other sources is 3.3 times as high as Federal OCS development.

c. Impact on Public Service and Facilities

i. Discussion: This section will discuss the possible impacts to the water supply, wastewater treatment systems, onshore transportation systems (roads, airports, railroads), and power generating facilities from the proposed action. Other public facilities and services (e.g. schools, parks, police and fire protection) are not discussed. These facilities and services are impacted by population increases. As discussed in IV.E.3.a, Demography, population increases associated with OCS development from this proposal will be insignificant (less than 0.5%) when considering overall expected population growth.

Proposition 13, passed by California voters in 1978, has seriously impinged upon the local jurisdictions' ability to respond to changing demands for public services and facilities by reducing local government's ability to raise revenues. The impact of reduced revenue availability is just now being felt with reduced levels of services, budget deficits, and reduced government employment. The long-term impacts of reduced funding on services and facilities in terms of maintenance, repair, upgrading, or new construction may result in even further reduced services, more frequent system breakdowns or failures, or moratoria on new connections.

Water supply, wastewater treatment facilities, onshore transportation systems, and power generating facilities may be impacted during all phases of exploration, development, and production for offshore oil and gas. The following is a discussion of the impacting agents.

Exploration. Demand for water is generated by the possible need to supplement

the drilling vessels' onboard desalinization capabilities, and provide water to crew and passengers on crew and supply boats for drinking, food preparation, sanitation needs, and personal hygiene. The temorary supply base will need water for sanitation needs, cleanup purposes, to supply water to the supply and crew boats, and to provide for the needs of any local office facilities. The office may be located at the base and use the supply base water hookups, or if located elsewhere, it will require local water service.

Wastewater disposal facilities, e.g., sewer hookups, will be needed at the supply base for the base employees and disposal of supply and crew boats' wastes. The local office may either use the base facilities or require service from the local service company. These facilities may be permanent installations or temporary accomodations, e.g., trailers, portable outhouses.

Transportation systems may be impacted by increased traffic. Increased traffic on roads may be caused by local employees traveling to and from work, and by truck traffic bringing in supplies to the supply base. This increased traffic could result in increased numbers of traffic accidents and an increase in the rate of road deterioration, thus, increasing costs to the local jurisdiction. Air traffic may be impacted by increased numbers of helicopter flights originating from local airports or from the increased demand for airline flights from non-resident employees. Rail traffic may be impacted from increased demand for rail surface to bring in large amounts, or bulky supplies or equipment to the supply bases.

Electrical power will have to be provided to the supply base, and to any local offices. Drilling vessels provide their own power.

These impacts will continue for the duration of the exploratory drilling effort. A well takes 50 to 80 or more days to drill, depending on the well depth and the water depth. Crew and supply boats may make 1 trip every 2 or 3 days, depending upon the distance between the drilling vessel and the supply base or crew embarkation point.

<u>Development</u>. During development, the sources of impacts remain basically the same as for exploration. Water demand can be generated by the need to supplement a platform's desalinization equipment. Crew and supply boats, and pipeline-laying barges will require water for onboard uses. A permanent supply base may be established, with more employees, thus, requiring more water. A larger local office, either located at the supply base or elsewhere, may be established.

Wastewater disposal facilities needs are the same as for exploration, but permanent sewer connections and other facilities would be required.

Transportation impacts would be the same as for exploration, but may be increased as more employees, supplies, and equipment are needed during the development phase.

Additional electrical power might be required for the supply base. In addition, power may be supplied to a platform via a pipeline if the platform is close enough to shore.

<u>Production</u>. The production phase usually overlaps with the development phase and the services and facilities provided during development would be sufficient to accommodate production phase needs.

Once the original development phase has ceased and the field is in production, many of the requirements for public services and facilities would be greatly reduced because of a reduction in the number of employees and the need for supplies. Water may or may not be needed to supplement the platform's desalinization capabilities. With lower levels of activity, fewer crew and

supply boat trips are required, thus, less need for onboard water. The size of the supply base may be reduced and the number of employees also reduced, requiring less water than in the development phase.

No new wastewater treatment facilities or connections would be needed.

Lower levels or activity, that is fewer employees and reduced supply needs, would result in fewer impacts on transportation systems, but the same type of impacts would occur as discussed above.

The following resources would be subject to impact and the reasons why they may be impacted are discussed below.

Water Supply. Offshore development and related onshore facilities potentially demand large amounts of water. (Refer to Table IV.E.3.d-1.) In many areas of Central California, the water supply is limited or the water delivery system is stressed to near capacity. Continued overdrafting (removing more water from the water source than is replaced) may cause subsidence, reduction in water quality and, in coastal areas, saltwater intrusion. Any increased demand might further stress existing supply systems or decrease water availability for other new uses, domestic or industrial.

Wastewater Treatment Facilities. Existing sewage or wastewater treatment facilities in many parts of Central California are or near capacity. Temporary moratorium on new service hookups have been instituted in some towns. Other areas have adequate facility capacity to meet existing needs and to accommodate increased future needs. Generally, only urban areas are served by treatment facilities, rural areas and some urbanized areas are dependent upon septic tanks and leach lines. Suitable disposal sites for septic tank waste material are difficult to find and develop. Additional demands for wastewater disposal or treatment could strain already limited existing systems.

Transportation. Vehicle access to the coast is limited from Gaviota in Santa Barbara County up to the San Luis Obispo Bay Cities. A large portion of this section of the coast is controlled by Vandenberg Air Force Base. Access to the rest of the coast is via Highways 1 and 101. Both highways carry increased amounts of traffic during the tourist season. Increases in truck traffic, such as might be required to deliver supplies to local facilities associated with OCS development, could contribute to increased traffic congestion, especially in the summer months, and accelerate highway deterioration.

The degree of impact from this proposal on airports is dependent upon the airports' capacity to absorb new uses or increased traffic. Several of the airports are small and recreationally oriented, with little opportunity for industrially related growth. At all airports, traffic, both passenger and aircraft, increases on weekends and holidays indicative of itinerant or tourist use. The need to establish helicopter bases to service offshore platforms may

impact some airports causing displacement of current users. A positive impact could be the additional revenues generated for the airport operator (local government or private) from use fees.

Rail transportation of supplies and equipment would be feasible to San Luis Obispo and Santa Barbara counties (Santa Maria Basin) as the Southern Pacific Railroad tracks parallel the coastline from Santa Barbara to the San Luis

Obispo Bay Cities. North of there, the line heads inland and follows approximately the same path as U.S. Highway 101. New railroad sidings would have to be constructed to accommodate rail delivery of OCS related supplies and equipment.

Power Generating Facilities. The demand for electricity to service OCS related onshore facilities is not expected to cause any impacts. Existing supplies are adequate to meet any expected needs. Offshore platforms and drilling vessels are self-supporting, using large diesel engines to supply their power needs.

Overall impacts to public services and facilities throughout the Proposed Sale area would be moderate to very low, depending on the service or facility. Water supply and wastewater treatment facilities would experience moderate impacts, ie. local systems will experience stress. Transportation systems impacts would be low to very low, that is no significant impacts to airports or railroads and limited localized stress to traffic facilities and traffic patterns. There would be no significant (very low) impact to electrical power generation facilities. Airports and railroads under transportation and electrical power generating facilities will not be discussed further as no significant (very low) impact is expected from the proposed sale.

PROPOSED SALE AREA

The development scenario for the southern portion of the Santa Maria Basin predicts five platforms generally located off the southern San Luis Obispo County and northern Santa Barbara County coast. No new onshore processing facilities or marine terminals are predicted; it is assumed that adequate capacity will exist as a result of previous OCS sales. A supply base located in or near the western Santa Barbara Channel is assumed to exist and would serve as a crew and supply boat base for development from the proposal. Port San Luis will be used as a crew boat base.

The expected development from Proposed Sale No. 73 would increase or prolong the demand for local public services and facilities. This would result in a high impact (potentially significant shortterm stress and minor long-term stress) to the water system, requiring modification or expansion of the delivery system or implementation of conservation measures. Santa Barbara County is overdrafting (removing more water than is replenished) its water supply. Continuation of this process to supply water for an increasing population (from non-OCS related activity) and to meet the demands of an enlarged or prolonged OCS development activity will result in the high impact.

Increased demand for water will occur in San Luis Obsipo County from the development of Port San Luis as a crew base. The demand for water will be within the systems existing capacity. Little strain on existing facilities is expected. This use of Port San Luis will be require major modifications before use as a crew base would be allowed according to current County

planning policies and plans. There would be minor disruption of local transportation patterns (i.e., road traffic), a low impact, in areas where roads are few in number or not designed for heavy traffic (i.e., northern Santa Barbara County coast) and where traffic is already at maximum capacity (i.e., San Luis Obispo County near Port San Luis).

Wastewater treatment facilities in Santa Barbara County are currently being expanded and will be able to meet demand for the next 10 years. (Blayney Dyett, 1981) Wastewater treatment facilities in San Luis Obispo County are also adequate to meet expected needs. (San Luis Obispo Local Coastal Plan, 1981) Generally, impacts from this proposal are expected to be moderate, i.e., generally short-term stress on local systems.

AREAS OUTSIDE THE PROPOSED SALE AREA

No impacts to public services are facilities are anticipated outside the proposed sale area to the north (northern portion of the Santa Maria Basin), nor to services and facilities to the south (Santa Barbara Channel), with the possible exception of water delivery systems and wastewater treatment facilities. If a new supply base is not built in the western Santa Barbara Channel, supply boats would continue to use Port Hueneme as their base. This could cause minor short-term stress, a low impact, on existing water delivery systems and wastewater treatment facilities by increasing or prolonging current use. If a base is built in the western Channel, then moderate impact may occur to local water delivery systems as water for the base would be drawn from sources that are currently being overdrafted.

ii. Conclusions: Overall, the impacts to public services and facilities would be moderate, i.e. short-term stress of local systems that may be accommodated through time and with small use adjustments. Expected impacts to water supply systems would be high for the proposed sale area (significant short-term and some long-term impacts requiring modification of existing systems or construction of new facilities). Impacts on wastewater treatment facilities would be low for the proposed sale area, some localized stress. Impacts to transportation systems (road, air, railroad) would be low in the southern portion of the Santa Maria Basin (minor short-term stress on local systems). Impacts to the electrical power supply would be very low, or insignificant.

iii. Cumulative Impacts: As discussed in the Conclusion section above, impacts to Public Services and Facilities from this proposal would range from very low, to high. In the southern portion of the Santa Maria Basin, the cumulative impacts from this proposal, existing and proposed development on existing leases and on leases in the western Santa Barbara Channel, development of Proposed State leases between Point Conception and Point Arguello, onshore development associated with the space shuttle and other military activities at Vandenberg Air Force Base and development of the Point Conception LNG facility could be significant for the water supply in northern Santa Barbara County.

This area of the County is currently overdrafting its ground water supply, and increased demands for water from offshore and onshore development, and associated commercial and housing growth could increase the amount of over-

drafting. Continued overdrafting of the ground water supply could lead to subsidence, salt water intrusion and lowering of the water table (Blayney-Dyett, 1981).

In 1979, Santa Barbara County voters rejected a bond issue for construction of a tie-in to the State Water Project, so other methods of providing for the water needs of the northern county area will have to be found. Southern San Luis Obispo County could experience, and may be experiencing, spillover growth from the activities in northern Santa Barbara County.

People desiring to live in a beach community may settle in or near the San Luis Obispo Bay cities and commute to jobs at Vandenberg AFB, the proposed LNG site, or other development activity. The City of Santa Maria, as an urban focus or center, could expand northward with development occurring in San Luis Obispo County. All this growth could cause increased overdrafting of water supplies from the Arroyo Grande groundwater basin. Wastewater treatment is adequate to accommodate some growth.

The impact from all proposed development in northern Santa Barbara County and southern San Luis Obispo County could be high (short-term stress and some long-term stress requiring modification of existing systems or construction of new facilities) to water delivery systems. Expected development from this proposed sale would add a small increment to the overall impact. The impact from the proposed sale, when considering all other proposals, would be low or some localized stress of a minor nature.

Larger sources of impacts would be from population growth associated with development on Vandenberg Air Force Base and the LNG facility. Other public services and facilities in the Santa Maria Basin should be adequate to handle projected increases in demand. Wastewater treatment facilities are now undergoing or have recently undergone modification or expansion and are capable of handling a 10-year increase in population (Blayney-Dyett, 1981). Transportation systems are adequate to meet new demands and power facilities will also be adequate.

d. Impact on Coastal Land Use

i. Discussion: This discussion of the impacts to land use is limited, for the most part, to lands within the coastal zone as defined by the California Coastal Act of 1976 (CCA). Land use within the coastal zone is regulated by California Coastal Commission approved Local Coastal Programs (LCP) and Port Master Plans. Most lands within the coastal zone of Central California are currently zoned for rural type uses -- agriculture, grazing, natural resource protection (i.e., forests and parks), open space, development with large minimum parcel sizes, and military. There is little acreage zoned for industrial use or in the special category of Coastal Dependent Industry (CDI). Housing availability in all price ranges is limited in the coastal zone and in coastal areas. There is a serious shortage in the low to moderate price range.

Primary impacts on land use will result from the demand for land for support facilities necessary for the exploration, development, production, and transportation phases of OCS oil and gas activity. In addition, there may be secondary impacts caused by demands for changes in existing land use to support

TABLE IV.E.3.d-1

LAND AND WATER REQUIREMENTS OF
ONSHORE DEVELOPMENT

	Land Required (acres)	Harbor Required yes/no	Wharf/length/ water depth (ft)	Water million gal/year
Temporary Service Base	5-10 flat	Yes-all weather	200/15-20	5.2/rig
Permanent Service Base	50-75 flat	Yes-all weather	400/15-20	8.2/platform
Repair & Maintenance yd.[1]	Similar to a Supply Base			5/platform or pipeline
Bases Supporting Pipeline and Platform Installation	5-10	Yes	200/400/15-20	
Pipelines/Landfalls	50-100 ft. Row[2] 40-60[3]	NA	NA	NA
Processing Facilities				
Partial Processing	15/100,000 bbl processed	NA	NA	0.12
Gas Processing & Treatment	50-75	NA	NA	73
Marine Terminals	30-200 (waterfront)	NA	NA/50-60	
Refineries[1]	1000-1500 flat	NA	NA	3832.5
Platform Fabrication Yds[4]	400-800	Yes	[5]/15-30	36.5

1 No new facilities are anticipated from this proposed sale, only possible expansion or modification of existing facilities.
2 Right of way width.
3 40 acres if a pump station is needed, 60 acres for a marine terminal.
4 Steel Platform Fabrication Yard, requirements for a concrete platform are less.
5 Sea access 200-350 feet horizontal and vertical clearance.

Source: NERBC Factbook, 1976

any population increases resulting from OCS operations. This increased demand for land could be expressed as an increase in the demand for housing, schools, or recreation sites. See also Public Facilities and Services (IV.E.3.c).

It is important to realize that any development (industrial or other) resulting from the proposal that occurs within the coastal zone would be subject to the land use controls of the local jurisdictions. It should also be noted that oil and gas related land development is dependent upon the amount of hydrocarbons discovered and developed.

The most significant impact agents to coastal land use is the construction of support facilities whose use is necessary in the development of offshore oil and gas. These support facilities have different requirements in terms of the amount of land required and the need for harbor facilities. The information presented below and in Table IV.E.3.d. on the needs of onshore support facilities is based on the NERBC/RALI <u>Factbook</u> (Nov. 1976).

Land based development includes temporary service bases that are staging areas from which equipment, supplies, and personnel can be ferried by supply boats and helicopters to offshore rigs during the surveying and exploratory or development drilling stage. Permanent service bases are set up as development and production phases get underway with a commercial find. Permanent bases perform the same functions as temporary bases, the principal differences are the size, and the intensity and amount of activity.

Repair and maintenance yards may be required to provide services for offshore vessels and equipment. These yards require locations accessible to road, rail, and air transportation. It is unlikely that such yards catering specifically to the needs of the petroleum industry would be newly sited in a frontier area. It is expected that these services could be rendered by existing marine repair capacities which could experience expansion pressures in a direct relationship to the amount of offshore activity.

Bases supporting platform and pipeline installation may be located separate from or contiguous to other service bases. These bases would require flat land for waterfront warehouse space, pipe-coating yards, service/maintenance facilities for the vessels and barges, and possibly land for a helipad. Pipelines and landfalls would be required for bringing the oil onshore. Landfalls require a 50-100 foot right-of-way, and, if needed, a pumping station or a marine terminal. Land use impacts are dependent upon whether the pipeline would cross marshes, sand spits, beaches, open fields, or urban areas.

Depending on the location and size of the offshore hydrocarbon find, how the oil and gas will be transported, and the ultimate destination of the hydrocarbons, the following facilities may need to be constructed onshore: oil and gas processing and treatment plants, marine terminals, or refineries. Oil and gas processing plants require relatively flat terrain, located reasonably close to the pipeline landfall (within 2 or 3 miles) to minimize pipeline construction, and near a marine terminal if the oil is to be tankered.

If oil is shipped via pipeline, there is less need for coastal location of facilities. Marine terminals require flat land for oil storage tanks, and ocean frontage to accommodate ships for dock side loading or loading from a floating mooring. Refineries require 1,000+ acres of flat, cleared, industri-

ally zoned land with access to rail and port facilities and highways.

Platform fabrication yards require flat well drained acres with unrestricted access to the ocean. Industrially zoned cleared land is preferred to allow for maximum flexibility in design and construction layout.

No new platform fabrication yards, refineries, or repair and maintenance yards are expected to be developed as a result of this proposed sale. Existing facilities would be able to accommodate anticipated industry needs with minor expansion or modification.

The impact from the demand for coastal land may have a variety of effects and, depending upon the area, these impacts could be significant. If the demand occurs in an area not already zoned industrial, there would be a change in the character of the land and this would require plan amendments to existing zoning plans (LCPS and General Plans). This could also remove land from renewable resource production, i.e., agriculture or grazing.

Generally, limited amounts of land in the coastal area are zoned for industrial use or Coastal Dependent Industry, and so, commitment of this land to oil and gas related facilities would reduce the amount available to other industries. Other industries may employ a larger percentage of the local workforce. This is an important consideration when considering the high unemployment figures in many coastal counties. (See also Coastal Economy, IV.E.3.a.) Development of oil and gas facilities within the coastal zone could also increase the number of pollution sources, both air and water. (See also Water Quality IV.E.1.a and Air Quality IV.E.1.c.) The impacts to land use from the proposed sale are expected to be low with little incompatibility with existing land uses.

The other major impacting agent to land use is population increase and its associated conversion of land to urban uses for housing, commercial, and public services and facilities (see also IV.E.3.c). Housing availability in coastal California is limited in all price ranges but especially in the low and moderate ranges. Increases in population from employees in OCS development related jobs would increase the demand for housing in all price ranges.

This may result in the conversion of rural or semi-rural acreage to urban housing. Along with land conversions to housing uses, there will be conversions to commercial uses and to public services and facilities (i.e., schools, water treatment plants) uses. Table IV.E.3.d-2 shows the anticipated increase in housing needs based on anticipated population increases associated with OCS development. As discussed in Demography (IV.E.3.a), population increases associated with offshore oil and gas development are expected to be very small when viewed in terms of the overall general population increases.

Regionwide, the impacts to housing availability are expected to be very low, a less than 1 percent increase in the total need for housing from OCS related population growth when compared to the expected population growth. (See IV.E.3.a and b and Fernandez (1983) for demographic and economic impacts and analysis.) No further analysis of housing will be done.

The following discussion of impacts utilizes the Transportation Scenario No. 1 (Yamasaki, 1983) as a reasonable estimate of what might occur if the expected

TABLE IV.E.3.d-2

PROJECTED NEW HOUSING NEEDS
CENTRAL CALIFORNIA

Total Number of Housing Units[1]	Population Theoretically Accommodated by Existing Housing[2]	Number of Additional Units Needed to Accommodate: 1990 Pop. Est. Without the Proposal[3]	1990 Additional Population From the Proposal[4]	% of Increase 1980 to 1990: Without Proposal	With Proposal	% Increase in Housing From OCS Development
396,098	1,049,659	28,770	509	7.3	7.4	0.1

1 Bureau of Census, 1980 Census Figures.

2 Multiply number of housing units by the regional average household size.
Central Coast = 2.65.

3 1990 est. population without the proposal minus 1980 accommodated population divided by regional household size.

4 1990 population estimate with the proposal minus 1990 population estimate without the proposal divided by the national average household size (2.75).

Source: Bureau of Census, State of California, Minerals Management Service

resources are found. The transportation scenario is to provide a commonality for discussion purposes, there are no recommendations made or implied. The

information presented was developed from local coastal plans and from discussions with local planners. See also IV.A.5, IV.A.6, IV.E.3.c, k to o, and Yamasaki (1983) for more detailed information on transportation and related information.

PROPOSED SALE AREA

The development scenario for the southern portion of the Santa Maria Basin suggests placement of five platforms, generally located off southern San Luis Obispo County and northern Santa Barbara County coasts. Transportation Scenario No. 1 proposed two pipelines to transport oil and gas ashore. One pipeline would connect the more northerly platforms and come ashore in San Luis Obispo County near the Santa Maria River. The other pipeline would connect the southerly platforms and come ashore at Point Conception. It is assumed for the most part adequate onshore facilities would be in place as a result of previously held sales, thus, few new facilities are proposed.

The following facilities are currently in various planning stages and are assumed to be in place to serve the needs of hydrocarbon development resulting from this proposed sale: 1) onshore coastal pipeline from Nipomo Mesa to Gaviota, 2) a supply base at Gaviota, 3) a modern marine terminal at Gaviota, 4) processing facilities at Gaviota, 5) an onshore or offshore oil pipeline from Gaviota to Los Angeles. (Yamasaki, 1983).

The single new facility expected to result from this proposed sale is the establishment of a crew base at Port San Luis. A crew base at Port San Luis is an allowable use under the San Luis Obispo County's Local Coastal Program (adopted 10/13/81) and general plan (adopted 10/13/81). Heavy equipment and large quanties of supplies are to be handled out of existing (Hueneme) or assumed existing (Gaviota or Vandenberg) facilities or supply bases.

Development of a crew base at Port San Luis would require a Development Plan which must include a detailed examination of alternate sites from Port SAn Luis south to the Santa Barbara Channel a phasing plan for development, oil spill contingency plans, a fire protection plan and an identification of necessary buildings and facilities and potential siting locations. This last item is to conform with County policy to site all but the most necessary industrial facilities away from the coastline.

In addition any harbor improvements would have to be done so as to minimize conflicts with rectreational and commercial fishing uses. Study of the feasibility of improving the presesnt level of facilities and moorage for recreational and commerical fishing boats is required. No service (crew) base would be permitted north of Point San Luis unless alternate sites are more environmentally damaging or environmental impacts are mitigated to the maxium extent feasible.

Compliance with estblished county policies would minimize the land use impacts of establishing a crew base at Port San Luis. No other new development, other than connecting pipelines, is anticipated. Pipelines are permitted uses in all land use categories, with consideration given to protection of

the environment and pipeline safety. Expansion of existing or assumed existing facilites may occur as a result of this sale, but no land use impacts are anticipated as expansion would occur according to existing County policies and within previously designated (zoned) industrial areas. Impacts to land use from this proposed sale to Santa Maria Basin area will be low, that is some incompatibility with existing land use that may be mitigated through land use plans and the permitting process.

AREAS OUTSIDE THE PROPOSED SALE AREA

Additional land use impacts may occur outside the planning area if a platform fabrication yard is deemed a feasible development. Several large construction firms and oil companies have investigated, or are investigating, the possibility of locating a platform fabrication yard on the West Coast to deal with the potential demand for platforms from development off Alaska and off of the Pacific States (Oregon, Washington, California). To date, no yard has been built. A French firm is currently investigating the possibility of locating a yard near Ensenada, Mexico. The use of gravel islands in Alaska OCS development and the few number of platforms proposed for offshore California development may limit the feasibility of constructing a base on the Pacific Coast.

ii. Conclusions: Impacts to land use in the Santa Maria Basin area will be low (some incompatibility with existing land uses that would be mitigated through land use plans and the permitting process).

Impacts to housing availability would be very low, a less than 1 percent increase in the need for housing for OCS related population growth, when compared to overall expected population growth.

iii. Cumulative Impacts: Whether or not Proposed Sale No. 73 occurs, land use would continue to be impacted. General population increases in all regions would continue the pressure to convert non-urban land uses to urban uses. The proposal would not significantly add to that pressure, since it would only increase the demand for new housing in 1990 from OCS related population growth by less than 1 percent. Development of the LNG Terminal at Point Conception will modify the existing land use, as will development at Vandenberg Air Force Base for the space shuttle. Demands for land for processing facilities, storage tanks, service bases and other support needs from previous sales would change the existing land use or land use zoning.

The proposal would not significantly add to this impact on land use as OCS development needs would be handled by facilities built as a result of earlier sales. Overall the cumulative impact to land use and housing from this proposal would be low (some incompatibility that can be mitigated through existing land use plans and the permitting process).

e. Impact on Commercial Fisheries

i. Discussion: Oil spills, manmade structures, and vessel traffic potentially can impact commercial fishermen. However, the commercial fishing industry consists not only of fishermen but people who work in associated support, processing, transportation and marketing jobs. Thus, impacts to fishermen may cause impacts to other parts of the commercial

fishing industry. The overall significance of impacts to the commerical fishing industry will depend on the magnitude of the economic loss to the industry as a whole (see definitions of impact level in Appendix A).

It is important to note that commercial fish harvests fluctuate dramatically under existing conditions, and any decrease or increase in the size of commercial fish harvests resulting from the proposal probably will be difficult to detect.

It is also important to note that many preventative measures already exist to protect commercial fisheries (see Section IV.B and MacGregor-Hanifan (1983)). Since impacts may occur even with these measures in place (see analysis below) there are three funds available to fishermen for compensation: 1) the Fishermen's Contingency Fund; 2) the Fishing Vessel and Gear Damage Compensation Fund; and 3) the Oil Spill Pollution Fund (see Section IV.B and MacGregor-Hanifan (1983)).

Oil Spills. Offshore oil and gas activities sometimes result in an accidental release of oil. These oil spills potentially can impact commercial fishermen by: 1) reducing the total available catch; 2) tainting marine organisms; 3) contaminating fishing gear and vessels; and 4) preventing fishermen from leaving port.

Reducing the Total Available Catch. Oil spills potentially can reduce the total available catch by reducing fish or invertebrate populations (see discussions in Section IV.E.2.a-c). The greater the reduction in available catch, the more likely it is that fishermen will be affected.

Tainting Marine Organisms. Direct coating or incorporation of hydrocarbons potentially can cause tainting of marine organisms (particularly shellfish), rendering them undesirable or unmarketable. Since fishermen (including mariculturists) may need to move the shellfish to clean water before marketing them so that the shellfish can cleanse themselves, moderate economic costs to commercial fishermen for about one month could occur if a large oil spill occurs and contacts important shellfish areas. Fishermen (other than mariculturists) could also sustain moderate economic losses for about one month if they choose to fish another area temporarily due to concern for harvesting tainted fish or shellfish.

Contaminating Fishing Gear and Vessels. Oil spills also potentially can impact commercial fishermen (including mariculturists) by contaminating fishing gear and vessels. Since oiled vessels probably would need to be cleaned, and oiled gear probably would need to be cleaned or replaced, moderate economic costs to commercial fishermen for about one month could occur if a large oil spill occurs in an important fishing area that fishermen continue to fish. Fishermen (other than mariculturists) also could sustain moderate economic losses for about one month if they choose to fish another area temporarily due to concern that their gear and vessels will be contaminated.

Preventing Fishermen from Leaving Port. If a large oil spill contacts a fishing port, fishermen could be prevented from leaving port by oil containment booms as occurred during the 1969 Santa Barbara oil spill. This could

result in very high economic losses to fishermen during the period the oil spill hits shore, and may force a few fishermen out of business.

Manmade Structures. Platforms, subsea pipelines, subsea wellheads (wells connected by pipelines to a platform or part of a subsea completion system), marine terminals, temporary abandonments (temporarily abandoned subsea wellheads), harbors, and other manmade structures may be used during various stages of oil and gas activities (see discussion in Section IV.A.5). Also, although MMS regulations prohibit the disposal of debris, a small amount may accidentally be lost, particularly in adverse weather.

Platforms, subsea wellheads, marine terminals, temporary abandonments, and debris potentially can result in lost fishing space, time and gear. The fisheries most likely to have significant conflicts with these offshore structures are the commercial trawl fisheries, but purse seining may have some conflicts (see discussion in Centaur Associates, Inc., 1981). Since most manmade structures are required to be marked by a suitable aid to navigation, fishermen usually can avoid these structures. In general, a maximum radius of 1,320 feet may be lost around all structures if fishermen choose to observe the payment criteria of the Fishermen's Contingency Fund (see Section IV.B and MacGregor-Hanifan (1983)). However, if a large number of these structures are placed in important trawl grounds, fishermen may attempt to fish close to these structures. This activity could result in lost fishing time and gear since fishing nets could be damaged or lost if the nets hang up on these structures. Similarly, lost fishing time and gear could result if fishermen's nets hang up on debris. Thus, platforms, subsea wellheads, marine terminals, temporary abandonments and debris could result in a small economic loss to fishermen if a large number of these structures are placed in important trawl grounds.

Of greater concern are subsea pipelines since they often traverse a large area. Until recently, pipelines in California have created very few problems for commercial fishermen since fishermen are able (and often choose) to fish over the pipelines. However, commercial trawl fishermen in the Santa Barbara Channel expressed concern about fishing in one area due to wood collars used to hold pipelines together while the pipelines were laid. This method of laying pipelines is no longer used. Also, commercial trawl fishermen in the Santa Barbara Channel have not been able to fish another area (12 square miles) for three years as a result of pipeline laying activities. Fishermen have not been able to trawl this area because their nets hang up on anchor scars (mud mounds and trenches) created by anchors from the pipeline lay-barge. Although OCS Order No. 9 (see Section IV.B and MacGregor-Hanifan (1983)) requires that pipelines be installed and maintained to be compatible with commercial trawl gear, it is not clear what needs to be done differently in the future to avoid the problem, although pipelines laid after the one discussed above have not caused any problems. It is also not clear whether this problem is likely to occur in the proposed sale area. However, it is assumed that this problem may occur if a large number of miles of pipeline are laid, since parts of the proposed sale area have sediments similar to sediments near the Southern California pipeline discussed above. MMS plans to fund a study this year to answer these questions.

At the same time, platforms can provide benefits as navigational aids and places to obtain emergency help in case a vessel is disabled or a crewman injured. Platforms also could be used for mariculture operations (particularly for growth of mussels and abalones). Although production platforms and

probably other offshore structures act as artificial reefs that attract fish

(Carlisle et al., 1964; Simpson, 1977), this most likely will have a slight impact on most fish populations and may not benefit fishermen since oil companies generally discourage fishermen from anchoring or otherwise floating next to a platform.

In harbors, competition between the oil and gas industry and commercial fishing industry potentially can occur for: 1) port space; 2) labor; and 3) fuel and repair facilities. The significance of these impacts will depend on the specific port used to support offshore oil and gas activities.

Vessel Traffic. Oil and gas operations usually use tankers, supply boats, crew boats, and geophysical vessels (see Section IV.A.6 and Yamasaki (1983)). These vessels will cause some conflicts with commercial fishing boats. A large number of tankers, supply and crew boats could cause a small economic loss and a very large number of vessels could cause a moderate economic loss since fishermen will need to maneuver around them if these vessels cut across the fishermen's intended path (instead of avoiding the fishing boats). In foul weather, additional vessels traveling through an area can become a significant hazard, particularly if they do not maintain safe speed levels. Conflicts between fishing boats and geophysical vessels also can occur since the geophysical vessels pull a cable behind them. This cable is usually about 3.2 km (2 miles) long and precludes fishing in the area while geophysical work is being conducted. Also, the cable sometimes becomes entangled with stationary fishing gear such as crab pots resulting in disruption or loss of the fishing gear (when the buoy is separated from the pot). The pots remain on the bottom catching crabs that eventually die in the traps, decreasing the number of crabs available to fishermen. Although these impacts have been significantly reduced recently by establishing communications between the oil and gas industry and the fishing industry, the potential still exists for a small amount of gear loss if a large number of geophysical vessels are operating and a moderate amount of gear loss if a very large number of geophysical vessels are operating.

THE PROPOSED SALE AREA

Within the proposed sale area, impacts to the commercial fishing industry as a whole are expected to be low (less than a 10 percent economic loss to the industry). However, trawl fishermen are expected to sustain moderate economic losses for at least 3 years due to pipeline laying activities. No effect on secondary employment (fish processing plants, etc.) is expected.

Oil Spills.

Commercial fishermen are not expected to sustain significant economic losses due to a reduction in total available catch since little, if any, reduction in commercial fish or invertebrate populations is expected as a result of the proposal (see Sections IV.E.2.a to c). However, although unlikely, if a large oil spill occurs and contacts a large school of northern anchovies, a small 1-2 year reduction in northern anchovy populations could result. Since anchovy stock is widely distributed and any decrease in stock is expected to be small, anchovy fishermen are not expected to be significantly affected by decreases in northern anchovy populations.

Commercial fishermen are not expected to sustain significant economic losses from oil tainting marine organisms, contaminating fishing gear and vessels, or preventing fishermen from leaving port since: 1) the probability that a large oil spill will occur and contact important shellfish areas (potentially resulting in tainting) is very low even after 30 days (e.g., 2 percent Cayucos mariculture operations, 2 percent Morro Bay mariculture operations); 2) the probability that a large oil spill will occur and contact important fishing areas (potentially resulting in contamination of fishing gear and vessels) is very low even after 30 days (e.g., 7 percent Port San Luis (Avila) area); and 3) the probability that a large oil spill will occur and contact a fishing port (potentially resulting in fishermen being prevented from leaving port by oil containment booms) is very low even after 30 days (e.g., 2 percent Morro Bay, 7 percent Port San Luis (Avila)). However, although unlikely, if a large oil spill contacts important shellfish or fishing areas, fishermen could sustain moderate economic losses for about one month. Also, although unlikely, if a large oil spill contacts a fishing port and fishermen are prevented from leaving port by oil containment booms, fishermen could sustain very high economic losses during the period the oil spill hits shore, and a few fishermen may be forced out of business.

Manmade Structures. Five platforms, 114 miles of subsea pipelines, and an unknown amount of debris are expected to be placed in proposed sale area. No subsea wellheads, marine terminals and temporary abandonments are expected in this basin. The platforms and debris are not expected to be concentrated in one area, so they are not expected to significantly impact commercial fishermen. However, since a large number of miles of pipeline are expected to be placed in this area, it is assumed that anchor scars from the pipeline laying process will preclude trawl fishing in an important fishing area. This preclusion is expected to cause a moderate economic loss to trawl fishermen in this basin since trawling is concentrated in relatively few areas. Based on experience with the Southern California pipeline discussed above, fishermen are expected to be precluded from fishing this area for at least 3 years. Therefore, trawl fishermen in the proposed sale area are expected to sustain moderate economic losses for at least 3 years due to pipeline laying activities. The trawl fishery in this area landed approximately one-third million dollars worth of fish during 1976 (the most recent year for which comprehensive data is available). When the contribution of the support, processing, transportation, and marketing industries are considered, the value of the trawl fishery in the proposed sale area probably is over $1 million.

At the same time, the 5 platforms are expected to provide a small benefit to commercial fishermen as navigational aids and places to obtain emergency help.

Port San Luis (Avila) is expected to be used as a crew base for oil and gas activities resulting from the proposal. Centaur Associates, Inc. (1981) concluded the following with respect to the use of Port San Luis (Avila):

> "OCS crew and supply boats could anchor or moor in Port San Luis without causing conflicts between fishing vessels. Common usage of fuel facilities would occur but congestion would be minimal. There is not adequate diesel or electronic labor in the area to service the OCS vessels. Services would have to be contracted to labor

outside Port San Luis. Marine repair facilities would probably not be used in the area. Adequate labor is available to the commercial fishing industry, as most fishing vessels are part-time or owner operated. One site has the potential to be developed and service the offshore industry. This particular site would be best suited for smaller OCS vessels such as crew boats. Development costs would be very high."

Therefore, use of Port San Luis (Avila) is expected to create minimal impacts to commercial fishing, but development costs for the oil and gas industry are expected to be very high.

Vessel Traffic. Tankers (a peak of 39 round trips per year from the marine terminal at Gaviota), supply boats (2 round trips per week per platform or well site), crew boats (2 round trips per week per platform or well site), and geophysical vessels (trips per year unknown) are expected to cause a small increase in vessel navigational hazards and a small amount of fishing gear loss during years of peak activity.

AREAS OUTSIDE THE PROPOSED SALE AREA

Central California. In Central California, impacts to the commercial fishing industry as a whole are expected to be very low (economic loss insignificant).

Oil Spills. Commercial fishermen are not expected to sustain significant economic losses due to oil spills.

Commercial fishermen are not expected to sustain significant economic losses due to a reduction in total available catch since little, if any, reduction in commercial fish or invertebrate populations is expected as a result of the proposal (see Sections IV.E.2.a-c). However, although unlikely, if a large oil spill occurs and contacts the mouths of rivers where salmon concentrate, a moderate reduction in these salmon populations, lasting 5 years or more, could result. Since competition for limited salmon resources is already very high, this reduction in salmon populations could force a few salmon fishermen out of business. Also, although unlikely, if a large oil spill occurs and contacts Pacific herring spawning grounds, a moderate reduction in these Pacific herring populations, lasting 3-5 years, could occur. Since competition for herring resources is not particularly high, these decreases in herring populations are not expected to significantly affect herring fishermen. In addition, although unlikely, if a large oil spill occurs and contacts a large school of northern anchovies or squid, a small 1-2 year reduction in these populations could result. Since anchovy and squid stocks are abundant and any decrease in stocks are expected to be small, anchovy and squid fishermen are not expected to be significantly affected by decreases in these populations.

Commercial fishermen are not expected to sustain significant economic losses from oil tainting marine organisms, contaminating fishing gear and vessels, or preventing fishermen from leaving port since: 1) the probability that a large oil spill will occur and contact important shellfish areas (potentially resulting in tainting) is very low even after 30 days (e.g., 0 percent Drakes Estero mariculture operations, 1 percent Elkhorn Slough mariculture operations, 1 percent Monterey Bay mariculture operations); 2) the probability that a large oil spill will occur and contact important fishing areas (potentially

resulting in contamination of fishing gear and vessels) is very low even after 30 days (e.g., 1 percent Monterey Bay area); and 3) the probability that a large oil spill will occur and contact a fishing port (potentially resulting in fishermen being prevented from leaving port by oil containment booms) is very low even after 30 days (e.g., 0 percent Drakes Bay (Pt. Reyes), 0 percent San Francisco Bay ports (Richmond, Berkeley, Sausalito, Oakland, San Francisco), 0 percent Princeton, 1 percent Santa Cruz, 1 percent Moss Landing, 0-1 percent Monterey). However, although unlikely, if a large oil spill contacts important shellfish or fishing areas, fishermen could sustain moderate economic losses for about one month. Also, although ulikely, if a large oil spill contacts a fishing port and fishermen are prevented from leaving port by oil containment booms, fishermen could sustain very high economic losses during the period the oil spill hits shore, and a few fishermen may be forced out of business.

Vessel Traffic. Tankers (a peak of 39 round trips per year from the marine terminal at Gaviota) are expected to cause a minor increase in vessel navigational hazards during years of peak activity. Gear loss from geophysical vessels is not expected to be significant since the cable probably will not be extended behind the vessels when the vessels pass through this area.

Southern California. Little, if any, impact to Southern California fishermen is expected as a result of the proposal.

Oil Spills: Little, if any, impact from oil spills is expected since the probability of a large oil spill occurring and contacting this area is low even after 30 days (e.g., 14 percent northern half of San Miguel Island, 4 percent northern half of Santa Cruz Island, and 0-2 percent for all other areas). However, although unlikely, if a large oil spill occurs and contacts important shellfish or fishing areas, fishermen could sustain moderate economic losses for about one month. Also, although unlikely, if a large oil spill contacts a fishing port and fishermen are prevented from leaving port by oil containment booms, fishermen could sustain very high economic losses during the period the oil spill hits shore, and a few fishermen may be forced out of business.

Anchovy fishermen are not expected to be significantly affected by decreases in anchovy stock since anchovy stock is widely distributed, any decrease in stock is expected to be small.

Manmade Structures. Manmade structures are not expected to significantly affect Southern California fishermen since the only new structure expected in this area is a supply boat base at Gaviota, a facility that commercial fishermen do not use (the Gaviota marine terminal is expected to be built as a result of previous oil and gas lease sales).

Vessel Traffic. Tankers (a peak of 63 round trips per year from the marine terminal at Gaviota) and supply boats (2 round trips per week per platform or or well site in the proposed sale area) are expected to cause a small increase in vessel navigational hazards during years of peak activity. Gear loss from geophysical vessels is not expecsted to be significant since the cable probably will not be extended behind the vessels when the vessels pass through this area.

ii. Conclusions: Impacts to the commercial fishing industry as a whole are expected to be low (less than a 10 percent economic loss to the industry). Trawl fishermen in the proposed sale area are expected to sustain moderate economic losses for at least 3 years due to pipeline laying activities, and some fishermen are expected to sustain small economic losses due to navigation hazards or gear loss during years of peak activity, but no effect on secondary employment (fish processing plants, etc.) is expected.

However, although unlikely, the proposal could result in a moderate impact to the commercial fishing industry as a whole (a 10-20 percent economic loss) if a large oil spill occurs and contacts: 1) the mouths of rivers where salmon concentrate (causing a reduction in salmon stock for 5 years or more and forcing a few salmon fishermen out of business), or 2) a fishing port (and fishermen are prevented from leaving port by oil containment booms during the period the oil spill hits shore, forcing a few fishermen out of business).

iii. Cumulative Impacts: Without the proposal, California commercial fishermen are expected to sustain economic losses due to natural fluctuations in fish and shellfish populations, competition with other fishermen, changes in market conditions, restrictions on fish harvests, existing offshore oil and gas leases (State and Federal), new State leases proposed to be sold between Point Arguello and Point Conception, tanker transportation of foreign and Alaskan crude oil imports, and other vessel traffic (see Sections I.C., III.B.1, III.B.2, III.B.3, III.C.5, III.C.6, III.C.12, IV.A.4, IV.C.3 and IV.D for descriptions of these actions).

Natural fluctuations in fish and shellfish populations, competition with other fishermen, changes in market conditions and restrictions on fish harvests probably are the most important stresses on commercial fishermen. Fishermen unable to find fish and shellfish or find a market frequently suffer high economic losses and some may be forced out of business.

Oil spills from existing leases, proposed leases, tanker transportation of foreign and Alaskan crude oil imports, and other vessel traffic potentially could also be an important stress. Over the life of the proposal, 3 large and many small oil spills are expected to result from existing federal leases (in the Santa Maria Basin and Southern California). Also, 5 large and many small oil spills are expected to result from tanker transportation of foreign and Alaskan crude oil imports (in California and Oregon). Based on the Oil Spill Risk Analysis Model, the areas expected to be contacted (by large oil spills) are near San Francisco Bay (Tomales Bay to Princeton) and the Santa Barbara Channel (mainland coast and northern halves of San Miguel, Santa Rosa and Santa Cruz Islands) (see Section IV.A.4-a). Other areas also may be contacted by oil since: 1) additional oil spills (number unknown) are expected to result from existing and proposed oil and gas development in state tidelands, and vessel traffic other than tanker transportation of crude oil imports, and 2) additional oil (amount unknown) is expected to be released as a result of natural oil seeps. The cumulative effect of oil from all of these sources is expected to result in: 1) a moderate economic loss to commercial salmon fishermen due to a reduction in salmon stock for 5 years or more, and 2) a moderate economic loss to other commercial fishermen since fishermen probably will be prevented from leaving port by oil containment booms during the period that a large oil spill hits shore (see discussion above).

Many manmade structures exist or are expected to be placed in California waters as a result of existing offshore oil and gas leases (State and Federal) and proposed leases (State). See Secstion IV.D.4 for details. Also, a small number of temporary abandonments and debris exist or are expected in these areas. The cumulative impact of all of these structures is expected to cause a moderate economic loss to trawl fishermen for at least 3 years since not all problems have been resolved with at least one existing pipeline in the Santa Barbara Channel, and it is possible that similar problems may occur with another pipeline when laid. At the same time, platforms provide a small benefit to commercial fishermen as navigational aids and places to obtain emergency help.

Vessel traffic from existing and proposed leases, tanker transportation of foreign and Alaskan crude oil imports and other ships usually creates low navigational hazards to fishing. Geophysical vessel operations from existing and proposed leases cause a small amount of fishing gear loss.

The cumulative effect of all of these stresses, particularly non-OCS related stresses, is expected to cause high economic losses to the commercial fishing industry. The proposal is expected to add a significant (small) amount to these losses, but this additional loss is not expected to substantially harm the commercial fishing industry.

f. Impact on Sportfishing

i. Discussion: Sportfishing in Central California consists primarily of shore, pier, skiff and commercial passenger fishing vessel (party boat) fishing, skin diving, and surf netting. It is subject to impact from offshore development from various sources. The main impacting agents are oil spills, onshore support facilities, vessel traffic, pipelines and offshore structures. (See Appendix A for definition of impact levels.)

Oil Spills. Offshore oil and gas activities sometimes result in an accidental release of oil. Based on the Oil Spill Risk Analysis Model, one large spill is expected for the southern portion of the Santa Maria Basin. Oil spills are the most significant impact-producing agent on sportfishing. An oil spill would deter sportfishermen from going to any area that was contaminated, due to possibility of the oil fouling boats and fishing gear, the tainting of the fish, and the extreme drop in the quality of the fishing experience. Oil spills have the additional potential of causing a reduction in fish and invertebrate populations which would lower the sportfishing catch. Adverse publicity of an oil spill will keep sportfishermen away from the affected area. Although many will fish in alternate areas, a large number will tend to not fish until a period of time has elapsed after the spill, in order to be certain that the quality of their fishing experience has not deteriorated.

Since shore and pier fishing comprise approximately 80 percent of the total sportfishing activities, significant impacts from oil spills would generally occur if the oil spill contacts the shoreline. Impacts due to loss of salmon and clam populations (see discussion in Section IV.E.2.c) would range from moderate (Less than 10 percent economic loss to the industry; most sportfishing still possible.) to high (a 10 percent or greater economic loss to the industry, most sportfishing stopped). Operators of commercial passenger fishing vessels

may sustain temporary moderate economic impacts due to adverse publicity of an oil spill, keeping the sportfishermen away from the affected area, or being confined to port by oil containment booms. In addition, if fish or invertebrate populations decrease due to impacts from oil spills or other impact agents (see discussion in Section IV.E.2.c), sportfishing could sustain low impacts (a small economic loss to the industry; most fishing continues) since there would be a loss in potential catch. These potential impacts are expected to be short term in duration.

The economic loss to the local economies due to a closure of a stretch of shoreline to fishing depends on the location, duration and season. The possible losses are shown for the proposed sale area and are based upon the Granville Corporation Study, 1981.

Onshore Support Facilities. Onshore support facilities could impact sportfisheries. Conflict with the utilization of the harbor and docking facilities would affect commercial passenger fishing vessels (party boats) and skiff rental operations.

Vessel Traffic. Increased vessel traffic in the form of work boats, crew boats, and tankers would impact sportfishing by increasing the possibilities of a collision due to the additional vessels traversing the area. The increased vessel traffic will also compete for berthing space with the sportfishing boats at the local harbor and could force some of the sportfishing operations to move to other locations.

Pipeline installations will cause a temporary reduction in sportfishing. The installation of a pipeline through the surf zone and across the beach will necessitate the closure of up to 400 meters of beach for up to 2 weeks. In order to minimize the impact to sportfishing, the installation of the pipeline should be conducted during the non-peak use season for the particular stretch of beach involved. However, once installation is completed, pipelines will have no effect on sportfishing in the area unless a break or rupture occurs in the line. If it is in a gas pipeline, then the impact would be the closure of part of the beach while the repairs are completed. If an oil pipeline ruptures then impact would also occur from the oil contamination of the sediment. The probability of a break or rupture occurring at the landfall is extremely remote and need not be addressed.

Sportfisheries are often enhanced by pipelines due to the artificial reef effect. These structures provide a suitable substrate for food and cover in areas that otherwise are largely devoid of these essentials. The actual value of the increased sportfishery potential in the vicinity of an offshore structure in California is limited.

Offshore Structures. Offshore structures would remove a small area from the sportfishing grounds which would have a very low impact (economic loss insignificant, a few fishermen affected by minor inconveniences, if any) to the sportfishing industry. Sportfisheries are often enhanced by offshore structures due to the artificial reef effect. These structures provide a suitable substrate for food and cover in areas that otherwise are largely devoid of these essentials. The actual value of the increased sportfishery potential

in the vicinity of an offshore structure in California is limited, however, since tying up to structures is prohibited, and anchoring or drifting next to a platform is discouraged.

Contamination of the area occurring from any effluents and discharge (Section IV.A.8.a) from offshore structures could potentially cause a reduction in the fish population in the area.

PROPOSED SALE AREA

Oil Spills. One large spill is expected to occur in the Santa Maria Basin as a result of the proposal. There is a small probability that the expected spill would strike the coast within 30 days (see Section IV.A.4).

If a spill does occur and strike the coast, locally, a very high impact (A 30 percent or greater economic loss to the industry; all fishing stopped for any length of time, or partial closure for an extended period of time.) to sportfishing could result. The spill could close down the sportfishing industry in the area affected for the duration of the spill. The length of time an oil spill would be retained on the beach would depend upon the size of the spill and oil retention of the particular stretch of coastline. In the proposed sale area, the oil retention varies from several days at Point Arguello to over a year in Morro Bay (Woodward and Clyde, 1982).

Sportfishing in the Santa Maria Basin has an economic value in excess of $6 million (The Granville Corporation, 1981). When this value is incorporated into the local economy, the total value of sportfishing would be increased by the output multiplier (2.35 based on The Granville Corporation, 1981) and would add over $14 million to the regional economy. If a spill occurred during the peak fishing season and closed down sportfishing for 30 days, approximately 15 percent of the value of sportfishing would be lost. However, any spill that does occur and contact the shoreline would have a high impact locally and a moderate impact to the area economy.

Onshore Support Facilities. Onshore support facilities would have a low impact because of competition for available space at Port San Luis due to the anticipated berthing of crew boats at the port. Supply boats would operate out of Gaviota where there are existing facilities.

Vessel Traffic. Vessel traffic increases will impact sportfishing due to the of crew boats, work boats, and tankers which are anticipated to be introduced to the area. The number of additional vessels and the number of trips for each of the vessels is given in Section IV.E.3.m. The impact to sportfishing from vessel traffic is anticipated to be very low in the southern portion of the Santa Maria Basin.

Pipelines. Two pipelines are expected as a result of the proposal. They would come onshore near Nipomo Mesa and Point. Conception. These would have a very low impact on sportfishing as the removal of the right of way from fishing would be of short duration.

Offshore Structures. The impact from the anticipated five platforms resulting from this proposal is expected to be very low. The area removed from the sport-fishing grounds would be very small; however, an increase in fish density is

expected around the platforms. Although fishing at a platform is discouraged, fishing in the area adjacent to the platform should improve and offset the loss of area.

The expected impact to sportfishing from the development of the proposed sale area is expected to be low at the local level, and very low for the salewide area.

AREAS OUTSIDE THE SALE AREA

Oil Spills. If a spill does occur and strike the coast, locally a very high impact to sportfishing would result. The spill could close down the sportfishing industry in the affected area for the duration of the spill. The length of time an oil spill would be retained on the beach would depend upon the size of the spill, and the oil retention of the particular stretch of coastline. In Central California the oil retention varies from several days at Pigeon Point to over a year in Elkhorn Slough (Woodward and Clyde, 1982).

Sportfishing in the Santa Cruz Basin has the highest economic value of all sportfishing in the region. The annual value of sportfishing is in excess of $46.6 million (The Granville Corporation, 1981). When this value is incorporated into the local economy, the total value of sportfishing will be

increased by the output multiplier (2.46 based on The Granville Corporation, 1981) and would add over $116.4 million to the local economy. The exact cost of any impact would depend upon the time of year, the exact location, and the size of the spill. Assuming that the sportfishing industry is closed down for 30 days during the peak season, approximately 15 percent of the value of sportfishing would be lost. However, any spill that does occur would have a high impact to the local affected area economics.

Sportfishing at the Channel Islands is restricted to party boat and skiff fishing, along with skin diving off boats. Along the mainland coast approximately 30 percent of the sportfishing is from manmade structures (piers, etc.), 30 percent is from the shoreline, and 40 percent is from boats. If a spill occurred and contacted the area a 30-day closure during the peak season would mean a loss of approximately $61,000. This will cause a moderate impact to the local economy and a low impact to the sportfishing in the region.

Onshore Facilities. No additional onshore facilities are proposed in the area outside of the proposal.

Vessel Traffic. Additional vessel traffic would impact sportfishing due to the increased number of crew boats, work boats and tankers in the Santa Barbara Channel area. The number of additional boats and the number of trips for each of the boats is given in Section IV.E.3.m. The impact to sportfishing from vessel traffic is anticipated to be very low in the Santa Barbara Channel, and the area north of the proposal.

Pipelines. No pipelines are proposed to come ashore in the area outside the proposal.

Offshore Structures. No offshore structures are proposed in the area outside the proposal.

ii. Conclusions: As a result of the proposal, the impact to sportfishing is expected to be low (a small economic loss to the industry, most fishing continues). If an oil spill does occur and contact the shore impacts would be very high (a 30 percent or greater economic loss to the industry, all fishing stopped for any length of time or partial closure for an extended period of time) for the immediate area. However, the likelihood of a spill occurring and contacting the shore is low. Economic impacts to sportfishing would depend upon the duration of the impact, the type of impact, the area impacted, and the time of year.

iii. Cumulative Impacts: Impacts to sportfishing would occur from various proposed projects and the existing conditions in the area. The expansion at Vandenberg Air Force Base, the Point Conception LNG Facility, the San Pedro Bay Coal Terminals, and the Port Hueneme Expansion will increase vessel traffic in the sale area. These activities have a very low impact to sportfishing. The proposed State Tideland Development would add to the vessel traffic in the area, and would also tend to remove a small area from the sportfishing grounds. Sportfishing is relatively minor in the area from Point Conception to Point Arguello; thus a very low impact is expected in this area.

The existing leases have a low impact due to the location of the leases and the amount of the development expected. These leases remove a small area from the sportfishing grounds, increase the vessel traffic in the area, and have a potential for a temporary closure of fishing in the area due to any oil spills which might occur. Regionally, the impact to sportfishing is low. The proposal does not significantly add to the impacts from these sources. The impacts are anticipated to remain low to the sportfishing.

g. Impact on Recreation

i. Discussion: Central California, although comprising 36 percent of the California mainland coastline, has an annual beach use participation in excess of 35 million visitor days (The Granville Corporation, 1981). For this reason, the area would be sensitive to impacts occurring as a result of the proposal. The impacts to recreation could result from oil spills, pipeline landfalls, onshore facilities, offshore structures, vessel traffic, noise and air quality. (See Appendix A for a listing of the levels of impact to recreation and their definition.)

Oil Spills. Offshore oil and gas activities sometimes result in an accidental release of oil. Oil spills are the most noticeable impacting agents to recreation, as they tend to preclude all recreation in the areas of contact. While still at sea, oil spills in this region would adversely affect all waterborne recreational activities including offshore cruising, racing, swimming, diving and fishing. Where oil spills contact the coast, they could restrict to port all boats which are in the harbor, due to the installation of booms. Most noticeably the impact to recreation will be seen where oil spills contact the shoreline. This will adversely affect seashore related recreational activities such as beachcombing, shell collecting, painting, shoreline nature studies, camping, sunbathing and using Off Road Vehicles. If only tar balls were present, most general beach use would still be possible. The loss of beach usage and

boating opportunities due to an oil spill could range from a very low (no closure of water-oriented recreational facilities, all beach and water use occuring with minor inconvenience, if any) to a very high (complete closure of all water-oriented recreation facilities for any length of time, or partial closure for an extended period of time, or a 25 percent or greater economic loss to the industry) impact to the local economy.

Very high impacts to the local economies were seen in Santa Barbara after the Santa Barbara spill (Mead and Sorensen, 1970), in Brittany after the AMOCO CADIZ spill (1,600,000 barrels) (AMOCO CADIZ Oil Spill, 1978), and at Padre Island, Texas after the IXTOC I spill (3,100,000 barrels) (Restrepo and Associates, 1982). These spills have been discussed in the FEIS for Sale No. 53 (BLM 1980) and Sale No. 68 (BLM 1981) and are considered to be larger than any possible spill occurring from this proposal.

In the event that a spill does occur, containment will be initiated as swiftly as possible, and when combined with the preparations of the local oil spill contingency plans, the impact to the shoreline could be lessened considerably. However, there could still be a closure of the beach for a period of time.

The time involved for cleanup operations depends entirely upon the size of the spill, the extent and type of shoreline impacted, the effectiveness of the cleanup equipment, the accessibility of the impacted area, the speed of the response team, and the weather.

Beach fouling and surface slicks could result from chronic spillage. This would be relatively minor compared to the major accidents, but could be a continual nuisance to the recreationists. The magnitude of these impacts would be comparable to those from the natural seeps. The overal impact on the beaches would be very low, and would tend to reduce beach use at a particular site on a day-to-day basis, as seen when the tar from the natural seeps impact the beaches in the Southern California area.

<u>Pipeline</u> installation would cause a temporary reduction in beach use at and near the landfalls. The installation of a pipeline through the surf zone and across the beach would necessitate the closure of up to 400 meters of beach for up to 2 weeks. In order to minimize the impact to recreation, the installation of the pipeline should be conducted during the non-peak use season for the particular stretch of beach involved. However, once installation is completed, pipelines would have no effect on beach use and general recreation in the area unless a break or rupture occurs in the line. If it is in a gas pipeline, then the impact would be the closure of part of the beach while the repairs are completed. If an oil pipeline ruptures, impact would also result from the oil contamination of the sediment. The probability of a break or rupture occurring at the landfall is extremely remote and need not be addressed.

<u>Onshore facilities</u> would impact any recreational facilities in the immediate vicinity, due to the oil and gas facilities causing a decrease in the pristineness of the area, thus, detracting from the recreational enjoyment. There is no expected impact to beach use from the placement of the onshore facilities other than those described for visual resources (Section IV.E.3.i).

<u>Offshore structures</u> have both beneficial and adverse effects on recreation. A single offshore structure or a concentration of offshore structures could in-

hibit visual quality, sailing, and boat racing, and may be a minor hazard to navigation in adverse weather. However, the structures also serve as good navigation markers and locations where emergency help can be obtained. There is no expected impact to beach use from the placement of the offshore structure other than those described for visual resources (Section IV.E.e.i).

Vessel traffic would have a very low impact on recreational boating due to the increase in vessels in the area with the introduction of work boats, crew boats, barges, and tankers. Vessels would also impact recreational boating by competing for existing berths at the local harbors.

Noise will be noticeable during all stages, but mainly during development and abandonment when construction and teardown occurs. Lower levels of noise would be found during the entire life of the sale from such sources as helicopters flying to and from the offshore platforms, and the increased number of boats operating in the area (See also Section IV.A.7).

Air quality changes would have an impact on recreation areas if pollution levels increase along with the corresponding aromatic effluents. These aromas, if they occur, would have a discouraging effect on the recreationists' desire to visit an area (For complete discussion of air quality, see Section IV.E.1.c).

PROPOSED SALE AREA

Oil Spills. One large oil spill is expected to occur in the proposed sale area as a result of this proposal.

If a spill does occur and contact the coastline, a closure of the affected beaches would occur for the duration of the spill. The length of time an oil spill would be retained on the beach would depend upon the size of the spill and the oil retention of the particular stretch of coastline. In the proposed sale area, the oil retention varies from several days at Point Arguello to over a year in Morro Bay (Woodward and Clyde 1982).

Closure of the beaches would have a major effect on the region due to the number of recreationists, approximately 11.6 million in 1980, who utilize the beach. The summer months are the period of high use in the area with approximately 40 percent of the beach use occurring between July and September (The Granville Corporation, 1981). This puts a heavy dependence by the local "Mom and Pop" businesses on the recreationists, as a large part of their revenue is obtained during the short recreation season. Any shift of the recreationist from the normal use area would create an economic crisis to the local communities. Relocation of these recreationists to other beaches in the region would not be possible in all cases due to travel cost and distance, beach capacity, additional time required to get to another facility and availability of a suitable facility. This would reduce the value of recreation to the local economy by an unknown amount.

The value of the coastal recreation in the proposed sale area is in excess of $99 million (The Granville Corporation, 1981). When this value is incorporated into the local economy, the total value of recreation will be increased by the output multiplier (2.35 based on The Granville Corporation 1981) and will add over $233 million to the economy of the local region. If a spill occurred during the peak use season, and closed down the recreational areas on the coast

for 30 days, approximately 15 percent of the annual value of the recreation in the affected area would be lost.

If the expected spill contacts the Point San Luis area, the impact to recreation with a 30 day closure would mean a reduction of approximately 350,000 recreationists with a corresponding loss of over $3 million in recreational value. This would remove about $7.3 million from the local economy.

If an oil spill contacted Point Arguello, the impact to recreation would be minimal, since the Point Arguello region is closed to public recreation due to Vandenberg AFB. The only areas in the Point Arguello area open to the public is Jalama Beach Park and Surf.

Pipelines. The installation of the anticipated pipelines will impact beach use at and near the landfalls during the construction phase. This will require the closure of part of the beach where the pipelines come ashore near Nipomo Mesa and Point. Conception for a period of one or two weeks. This will have a very low impact on general recreation, and full utilization of the area should be restored once installation is complete.

Onshore Facilities. Onshore facilities are anticipated to have a low impact (No closure of water-oriented recreations facilities, most beach and water use still possible, or less than a 5 percent loss to the industry.) on recreation as they are assumed existing, or to be constructed with similar facilities.

Offshore Structures. A low to very low impact on recreation is anticipated in the proposed sale area from the five platforms expected from this proposal. This impact would be in the form of removing a small area from the use of recreational boaters and sportfishermen. The visual degradation to the recreationists is based on the Visual Resources of the area and is given in Section IV.E.3.i.

Vessel Traffic. Increased vessel traffic will impact recreational boating due to the number of crew boats, work boats, and tankers which are anticipated to be introduced to the area. The number of additional vessels and the number of trips for each of the vessels is given in Section IV.E.3.m. The impact to recreation from vessel traffic is anticipated to be very low in the proposed sale area.

Noise. The impact of noise on recreation is anticipated to be very low for most of the life of the field. However, a moderate impact can be expected locally during periods of construction.

Air Quality. Air quality would not be expected to change significantly with no impact to recreation.

Overall the expected impact to recreation from the development of the Proposed Sale area is a moderate impact (Partial closure of some water-oriented recreational facilities, most beach and water use still possible, or a 5 percent or greater economic loss to the industry.) to the recreation industry for the local community, and a low impact to recreation in the overall basin or region.

AREAS OUTSIDE THE PROPOSED SALE AREA

Oil Spills. If a spill does occur and contact the coastline, a closure of the affected beaches would occur for the duration of the spill. The length of time an oil spill would be retained on the beach would depend upon the size of the spill, and the oil retention of the particular stretch of coastline. The oil retention varies from several days at Pigeon Point to over a year at Elkhorn Slough (Woodward and Clyde, 1982).

Closure of the beaches would have a major effect on the local region due to the number of recreationists, approximately 27.3 million in 1980, who utilize the coastal recreational facilities in the area. The summer months are the period of high use in the area with approximately 47 percent of the beach use occurring between June and September (The Granville Corporation, 1981). This puts a heavy dependence by the local "Mom and Pop" businesses on the recreationists, as a large part of their revenue is obtained during the short recreation season. Any shift of the recreationist from the normal use area would create an economic crisis to the smaller communities. Relocation of these recreationists to other beaches in the region would not be possible in all cases due to travel cost and distance, beach capacity, and additional time required to get to another suitable facility. This would reduce the value of recreation to the local economy by an unknown amount.

The value of the coatal recreation in the area north of the proposed sale is in excess of $288 million (The Granville Corporation, 1981). When this value is incorporated into the local economy, the total value of recreation will be increased by the output multiplier (2.5 based on the Granville Corporation, 1981) and will add over $720 million to the economy of the local region. If a spill occurred during the peak use season and closed down the recreational areas on the coast for 30 days, approximately 15 percent of the annual value of recreation in the affected area would be lost. This would be a high impact (Closure of most water-oriented recreational facilities, some beach and water use possible, or a 15 percent or greater economic loss to the industry.) to the recreation industry in the local communities.

If a spill occurs and strikes the Channel Islands, a low impact to recreation will occur, since the Islands have very limited recreational usage due to the limited access, with most recreation in the Santa Barbara Channel area occurring on the mainland. If the spill impacted the Santa Barbara area, a high impact could occur locally to the recreation industry.

Pipelines. No pipelines are proposed to come ashore in this area as a result of the proposal.

Onshore Facilities. No additional onshore facilities are proposed in the area outside of the proposal.

Offshore Structures. No offshore structures are proposed in the area outside of the proposal.

Vessel Traffic. Additional vessel traffic will impact recreaitonal boating due to the increased number of crew boats, work boats and tankers in the area. The number of additional boats and the number of trips for each of the boats

is given in Section IV.E.3.m. The impact to recreation from the vessel traffic is anticipated to be low in the Santa Barbara Channel and Central California.

Noise. The impact of noise on recreation is anticipated to be very low in the area outside of the proposed sale.

Air Quality. Air quality is expected not to change significantly.

ii. Conclusions: The proposed development is expected to have low impacts (no closure of water oriented recreational facilities; most beach and water use still possible; or less than a 5 percent loss to the industry) on recreation. If any coastal areas are actually contacted by an oil spill; the proposed development is anticipated to have moderate impact (partial closure of some water-oriented recreational facilities, most beach and water use still possible, or a 5 percent or greater economic loss to the recreation industry) to recreation over the entire region with high impacts (closure of most water-oriented recreational facilities, some beach and water use possible, or a 15 percent or greater economic loss to the recreational industry). The exact amount of economic impact to recreation will vary for each possible contact point and time of year of contact.

iii. Cumulative Impacts: Impacts to recreation occur both offshore and onshore from other projects and existing leases. The expansion at Vandenberg Air Force Base will cause a slight increase in vessel traffic in the proposed sale area, as will the Point Conception LNG Facility. Both of these activities have a very low impact to recreation. The State Tideland development will cause a moderate impact to recreation due to the offshore platforms, pipelines, onshore facilities, vessel traffic, noise, and oil spills in the area between Point Conception and Point Arguello.

The existing leases have a moderate impact in the proposed sale area due to the increased number of offshore platforms, pipelines, onshore facilities, the amount of vessel traffic, the noise in the area and the potential oil spills.

The proposal does not significantly add to the impacts from these sources. The impacts are anticipated to remain moderate to the recreation industry in the region.

h. Impact on Tourism

i. Discussion: Tourism is one of the largest industries in California, directly affecting more than one million jobs. Tourism is the non-routine travel to an area (California Office of Tourism, 1981b). However, in this analysis the business meeting and business oriented travel is omitted, and only the pleasure/vacation travel has been used to describe tourism. As it is dependent upon the scenic quality of the area, it is susceptible to impact from offshore oil and gas development. Impacts could occur from oil spills, offshore structures, onshore facilities, pipelines, noise and air quality. (See Appendix A for a complete list of the levels of impact to tourism and their definitions.)

Oil Spills. Offshore oil and gas activities sometimes result in an accidental release of oil. Oil spills will be the main impacting agent on tourism, as a spill could close sections of the coast to recreational use and have a degrading

effect on the visual quality wherever contact with the coastline occurs.

Central California has numerous tourist areas which are sensitive to impact from oil spills. The impact to the local economies can be approximated by estimating the number of tourists who would stay away from the area. This percentage would be greater for the small communities than for large cities. For example, in San Francisco, the majority of tourists spend part of their time sightseeing and/or attending cultural functions, as opposed to the small communities along the coast where tourists tend to spend their time relaxing at the beach, fishing or enjoying the local coastal environment. Thus, the small community whose economic base is heavily dependent on beach-oriented tourism could be more severely impacted than the larger communities. The larger city, however, would probably have a lower percentage of reduction in tourism, as there are numerous other activities which people would substitute. Businesses along the beach at the larger city would be more seriously impacted economically than their counterparts in the central business district of the city, but would tend to be more able to survive than their small community counterparts.

In the event that a spill does occur, there could be a closure of the beach for a period of time. The closing of the beaches would decrease the desire of tourists to go to the area, and due to the adverse publicity that is associated with spills, they would tend to stay away from the impacted area even after it was cleaned. This has been seen after major spills such as the Santa Barbara spill, the AMOCO CADIZ spill, and the IXTOC I spill. These spills are discussed, as well as the economic impact of the spill, in the FEIS for Sale No. 68 (BLM, 1981). These spills are considered larger than any possible spill occurring from this proposal.

The time involved for cleanup operations depends entirely upon the size of spill, the oil residence of the type of shoreline contacted (Woodward and Clyde, 1982), the extent of shoreline contacted, the effectiveness of the cleanup equipment, the accessibility of the impacted area, the speed of the response team, and the weather.

Beach fouling and surface slicks could result from chronic spillage. This would be relatively minor compared to the major accidents, but could be a continual nuisance to the tourist. The magnitude of these impacts would be comparable to those from the natural seeps. The overall impact on the tourism would be very low (no shutdown of tourist facilities, no drop in tourism, minor inconveniences, if any) and would tend to reduce beach use at a particular site on a day-to-day basis, as seen when the tar from the natural seeps impacts the beaches in the Southern California area.

Offshore platforms will cause a degradation to the visual quality of the proposed sale area as is stated in Section IV.E.3.i. This degradation will tend to have a very slight discouraging effect on people's desire to visit the area.

Onshore facilities will also cause a degradation is visual quality of the proposed sale area as is stated in Section IV.E.3.i. This degradation will tend to discourage people from visiting the locations where the onshore facilities are sited.

Pipeline landfalls will have a very minor temporary impact on tourism based

Offshore Structures. A very low impact on tourism is anticipated from the five platforms expected from this proposal if the platforms are separated. An increase in impact level up to low (No shutdown of tourist facilities, most tourism still occurs.) would be expected if the platforms are grouped. The visual degradation to the tourist is based on the Visual Resources of the area and is given in Section IV.E.3.i.

Onshore Facilities. Onshore facilities are expected to have a very low impact to tourism in the area. The onshore facilities are expected to be already existing or to be placed with similar facilities.

Pipelines. The predicted landfalls (Pt. Conception and Nipomo Mesa) for the proposal will not have a major impact on tourism. However, the installation of the pipeline would necessitate the closure of up to 400 meters of beach for up to 2 weeks. Since the beach at Pt. Conception is inaccessible due to the security at Vandenberg Air Force Base, the expected impact would be very low. Although the beach at Nipomo Mesa is more accessible the expected impacts from construction would also be very low.

Noise. Noise is anticipated to have a very low impact on tourism for the life of the field. However, a low impact can be expected locally during periods of construction.

Air Quality. Air quality is expected to not change significantly with no impact to tourism over most of the area. A very low impact is expected due to reduction in air quality which might occur at the processing plant from the hydrocarbon production from the proposal.

AREAS OUTSIDE OF THE SALE AREA

Oil Spills. If a spill does occur and contact the coastline a reduction in tourism would occur for at least the duration of the spill. The length of time a spill would be retained on the beach would depend upon the size of the spill and the oil retention of the particular stretch of coastline. In Central California the oil retention varies from several days at Pigeon Point to over a year in Elkhorn Slough (Woodward and Clyde, 1982).

Tourism in Central California is centered at Pt. Reyes, San Francisco, Santa Cruz, Monterey and Carmel, and is dependent upon the tourist attractions present at each of these centers and upon the scenic quality of the area (see Section IV.E.3.i.) As an example, the scenic quality of the Big Sur Coast is not the only attraction of the coastline, but also the manmade attractions such as Hearst San Simeon.

If an oil spill occurs and contacts the coast line for 30 days during the peak tourist season, it could cause a reduction in tourism large enough to cause a loss in tourist revenue of over $205 million (California Office of Tourism, 1981a; The Granville Corporaiton, 1981). When this value is incorporated into the local economy the total loss to the tourism in the area will be increased by the output multiplier (2.46 based on The Granville Corporation, 1982) and could result in a loss of over $517 million to the

regional economy. This would be a very high impact to the local communities involved and to the basin economy.

Tourism does not occur on the Channel Islands, but a very high impact to tourism could occur in the Santa Barbara area, if the expected spill from the proposal contacts that portion of the coast. Overall the expected impact to tourism in the Santa Barbara Channel is low.

Offshore Structures. No offshore structures are proposed outside the proposed sale area as a result of the proposal.

Onshore Facilities. No additional onshore facilities are proposed outside the proposed sale area as a result of the proposal.

Pipelines. No pipelines are proposed to come ashore outside the proposed sale area as a result of the proposal.

Noise. The impact of noise on tourism is anticipated to be very low in the Santa Barbara Channel area and north of the proposed sale area as a result of the proposal.

Air Quality. Air quality is expected to remain at current levels outside of the proposed sale area as a result of the proposal.

ii. Conclusions: Impacts to tourism are expected to be very low since no spills are expected to occur and contact the coastline. However, should a spill contact the coastlinne, there would be a moderate impact (partial shutdown of some tourist facilities, most tourism still occurs) to tourism. Tourism will tend to remain normal for the total sale area with localized reductions if a spill occurs and contacts the shoreline. For an area contacted by a spill, the impact to tourism could be very high (complete shutdown of tourist industry for any length of time, or partial shutdown for an extended time) if the area was contacted causing severe economic damage to the local communities.

iii. Cumulative Impacts: Impacts to tourism can occur due to other projects and existing leases in the area. The projects with the highest impact to tourism in the area are the Vandenberg Air Force Base expansion and the State Tidelands development. No tourism occurs at the beaches contained in Vandenberg Air Force Base due to the security of the installation. The State Tideland development is planned for a secluded stretch of coast south of Point Arguello which is partly off Vandenberg and partly off private property. Tourism in this area is in the form of campers at Jalama Beach Park. A moderate impact is expected locally due to State Tidelands development.

Existing leases from Sale No. 53 would have similar impact on tourism as the State Tidelands development has on Jalama Beach Park. A similar impact would also occur at Surf and Point Sal. These areas of the coast are not large tourist centers, so although a moderate impact could occur locally, the remainder of the proposed sale area would have a very low impact on tourism.

The impacts from the proposal would be significant in that they would raise these impacts to moderate for the tourist industry.

i. Impact on Visual Resources

i. Discussions: Visual Resources: The California coastline was described in the California Coastal Plan (California Coatal Zone Conservation Commission, 1975) as "an outstanding visual resource of great variety, grandeur, contrast, and beauty that can be enjoyed by all the people of the State". In addition the plan noted that the visual resources "add to the quality of life for coastal residents, visitors, and workers, and contributes to the economic success of the tourist industry by attracting many vacationers to the coastline." Impacts to the visual resources can occur from almost any source and vary in scope from small sources such as a Coastal Access Sign, to large sources such as major construction projects.

Oil and gas development has the potential to impact visuual resources from various sources. The main impacting agents to visual resources are offshore structures, oil spills, onshore facilities and pipelines (see Appendix A for a complete list of levels of imapct to visual resources and their definitions).

Offshore structures will cause the longest lasting, most prominent visual impact. The platforms are fairly prominent objects, exhibiting discordant vertical and angular lines against the soft horizontal plane of the sea. Portions of a 190-foot platform structure may be seen from the water's edge if it is located within 17 miles of the shoreline. From elevated vantage points, the visual range increases according to the elevation. At distances beyond about 15 miles, the size of platforms would appear very small and may be obscured by natural sea haze from 40 to 60 percent of the time.

The impacts from offshore platforms have been based on the Granville Corporation Study (1981). The stated impact was determined by the expected change in the aesthetic resource of the area based on OCS development. This tends to give a greater impact than is expected from the proposal, as the impacts are based on the platforms (singly or in groups of four) being 3 miles from shore, whereas in reality they will often be considerably farther offshore.

Offshore structures will cause the longest lasting, most prominent visual impact. The platforms are fairly prominent objects, exhibiting discordant vertical and angular lines against the soft horizontal plane of the sea. Portions of a 190-foot platform structure may be seen from the water's edge if it is located within 17 miles of the shoreline. From elevated vantage points, the visual range increases according to the elevation. At distances beyond about 15 miles, the size of platforms would appear very small and may be obscured by natural sea haze from 40 to 60 percent of the time.

The impacts from offshore platforms have been based on the Granville Corporation Study (1981). The stated impact was determined by the expected change in the aesthetic resource of the area based on OCS development. This tends to give a greater impact than is expected from the proposal, as the impacts are based on the platforms (singly or in groups of four) being 3 miles from shore, whereas in reality they will often be considerably farther offshore.

The entire coast has the potential for being impacted, only those areas which could have a moderate (visual quality degraded to an extent which affects about half the people in the area, no noticeable reduction in recreational use, no perceptible reduction in property values) or greater impact based upon the Granville study have been mentioned. Some of these areas are virtually inaccessible, however they are included because the criteria for impact does not include total number of visitors, only the change in the visual resources.

Oil Spills. Offshore oil and gas activities sometimes result in an accidental release of oil. Oil spills will impact visual resources of the area if they occur. The impacts would be noticeable mainly at the points of contact with the shoreline. The degree of impact would depend upon the size of the spill, the type of shoreline that is contacted, the weather conditions at the time of contact, and the aesthetic quality of that stretch of shoreline.

A flat, sandy coastline would tend to retain oil longer than a rocky or cobble coast, but not as long as an estuary or a lagoon. The oil retention for the Central California coast has been determined by Woodward and Clyde, and ranges from several days to over a year. Weather conditions will affect the impact of an oil spill in that the oil will generally be removed by reworking of the beach material by wave action. In general the greater the wave action the faster the oil will be removed from the beach.

Beach fouling and surface slicks could result from chronic spillage. This would be relatively minor compared to the major accidents, but could be a continual degradation to the visual resources. The magnitude of these impacts would be comparable to those from the natural seeps. The overall impact on the visual resources would be very low (No significant reduction in visual quality, few people notice changes, no reduction in recreational use or property values.), and would tend to degrade the aesthetic appeal of a particular site on a day-to-day basis, as is seen when the tar from the natural seeps impact the beaches in the Southern California area.

Onshore support facilities will have an adverse impact on visual resources, the degree depending upon the nature and number of the facilities and their location. Visual resource degradation could decrease recreational enjoyment of the beaches and coastal waters for some people. Onshore visual impacts during exploration could entail land use changes for equipment storage, heliports, communication and navigation equipment facilties, increased vehicular traffic, and construction activities. During the development stage onshore storage and processing facilities, pipeline installation; and pipeline and barge fabrication and equipment storage yards will all involve some deterioration of the visual resource onshore.

Pipelines would impact visual resources during their installation by the lay barge operating offshore and by the trenching for the pipeline onshore. This would only last during the installation period, however, the earth scar onshore would remain visible for a length of time dependent on the soil type and the native vegetion. This could last for several years in the case of a wooded area, or could be removed by the first winter storm in the case of a sandy backshore.

The magnitude of the impact to the aesthetic quality of the shoreline will depend upon the existing aesthetic quality of the stretch of coast, and the impacting agent. An oil spill on the more scenic stretches of coast will tend to have a greater impact than on other parts of the coast. However, any stretch of coast that is contacted by oil will have a very high impact (visual quality degraded to an extent that it affects all people in the area, or reduced recreational visitation to the area, or reduced property values).

PROPOSED SALE AREA

Offshore Structures. Five platforms are anticipated to be placed in the southern portion of the Santa Maria Basin as a result of this proposal. The impact from the platforms depends upon whether they are separated or grouped. If the platforms are in a group off the Pismo Beach area impacts are anticipated to be moderate. If there is only a single platform the anticipated impacts are low (Minor degradation in visual quality, most people accept the change, no reduction in recreational use or property values.). Throughout the remainder of the proposed sale area the expected impacts from platforms, either single or in group, is expected to be low.

Oil Spills. One large oil spill is expected to occur in the proposed sale area as a result of the proposal. If a spill does occur and contact the shoreline, a degradation in visual quality will occur and will remain until cleanup is accomplished either by man or by natural processes. The spill which contacts the shoreline will temporarily have a very high impact on the visual

resources of the area. The length of time of the impact will depend upon the size of the spill and the oil retention of the particular stretch of coastline. In the proposed sale area the oil retention varies from several days at Point Arguello to over a year in Morro Bay (Woodward and Clyde, 1982). The scenic quality of the shoreline in the proposed sale area is varied, and thus impact levels will vary depending upon which beach is oiled.

Onshore Facilities. Heliports are anticipated to be situated at San Luis Obispo and at Santa Maria, with a very low impact as they could be sited at existing airports. Crew boats would require berthing and a very low impact is expected as these are existing docks at San Luis Obispo Harbor.

Pipelines. Two pipelines are anticipated from development of the proposed sale area. The pipelines will come ashore at Nipomo Mesa and Pt. Conception. These pipelines are anticipated to have a very low impact at the landfall, and a low impact along the onshore right-of-way.

AREAS OUTSIDE THE PROPOSED SALE AREA

Offshore Structures. No offshore structures are proposed outside the proposed sale area as a result of the proposal. Therefore, no impact to visual resources is expected.

Oil Spills. One large oil spill is expected to occur in the proposed sale area as a result of the proposal.

If a spill does occur and contact the shoreline a degradation in visual quality will occur and remain until cleanup is accomplished either by man or by natural processes. The spill which contacts the shoreline will temporarily have a very high impact on the visual quality of the area contacted. The length of time of the impact will depend upon the size of the spill and the oil retention of the stretch of coastline. In Central California the oil retention varies from several days at Pigeon Point to over a year in Elkhorn Slough (Woodward and Clyde, 1982). The scenic quality of the shoreline in Central California is varied, and thus levels will vary depending which beach is oiled. On the Channel islands or on the Santa Barbara mainland this degradation would cause a very high impact, for the duration of the oiling.

Onshore Facilities. No additional onshore facilities are proposed in this area as a result of the proposal.

Pipelines. No pipelines are proposed to come ashore in this area as a result of this proposal.

Overall, no impact to visual resources outside of the proposed sale area is expected as a result of the proposal.

ii. Conclusions: The proposed development is anticipated to have a low impact (Minor degradation in visual quality. Most people accept the change. No reduction in recreational use or property values) to visual resources over the proposed sale area. The exact amount of degradation will depend upon the location and type of the OCS structure and/or spill, and the nature of the shoreline that is impacted.

iii. Cumulative Impacts: Impacts to visual resources occur both onshore and offshore from other projects and existing leases. The other projects include the expansion of Vandenberg Air Force Base which will entail the construction of launch sites for the Space Shuttle and the expansion of the boat dock at the old boathouse at Pt. Arguello. This will be a low impact to the visual resources of the area.

State Tidelands development will cause a degradation of visual resources with the introduction of platforms into the State waters between Point Conception and Point Arguello. This is anticipated to be a low impact to the visual resources in the area.

Existing leases will cause a low impact to the visual quality due to the placement of platforms in the Sale No. 53 area at the southern end of the Santa Maria Basin. The proposal does not significantly add to the impacts from these sources. The impacts are anticipated to remain low to the visual resources.

j. Impact on Cultural Resources

i. Discussion: The cultural resources subject to impact from offshore oil and gas development included prehistoric and historic sites, and areas of religious or ceremonial importance. Almost no work has been done offshore in Central California in regard to searching for prehistoric sites. There are no known and recorded submerged prehistoric sites, but numerous coastal eroding sites and coastal shell mounds are known.

The possibility of the existence of submerged prehistoric sites is suspected but high wave energies during transgression/regression episodes (sea level changes) may have destroyed any sites. Only sites in low energy areas such as lagoons and estuaries, and at low energy beaches are likely to have survived (MMS, 1982a). The difficulty in determining where sites might exist is in interpreting the geologic record of low energy areas back through the last 40,000 and 150,000 years.

Historic sites include both sites onshore such as lighthouses and National Historic Register sites, and sites offshore most of which are shipwrecks. Of the more than 1,500 recorded shipwrecks offshore California, over two-thirds are recorded north of Point Conception (MMS, Shipwreck File). This high number of wrecks is a function of the rocky coastline, the currents, and the frequent occurrence of inclement weather.

The main impacting agents to cultural resources are bottom disturbing activities, oil spills, onshore facilities, and the visual intrusion of offshore structures. (See Appendix A for a complete list of levels of impact to cultural resources and their definitions.)

Bottom Disturbing Activities. Bottom disturbing activities can include any activity utilizing anchors for stabilization; pipeline laying activities such as trenching, use of lay or pull barges; well drilling activities either during the exploration phase or during the development and production phase; and platform construction and anchoring. Additionally the placement of metal objects on the ocean floor (for example, pipelines, subsea completions, or lost equipment) may cover up the magnetic signature of historic resources during a

magnetometer survey. Failure to identify a resource during the survey phase may lead to its inadvertent destruction during construction or exploration. A more detailed discussion is presented in the FEIS for Sale No. 53 (BLM, 1980a).

Oil Spills. Offshore oil and gas activities sometimes result in an accidental release of oil. Oil spills can impact cultural resources in several ways. These include direct oiling of the intertidal gathering areas, degrading the viewshed of any historic, prehistoric, religious or ceremonial site, direct oiling of sites and/or resources, and inadvertent destruction of sites during cleanup.

The intertidal areas are used extensively for gathering purposes by various groups of people. With the increased awareness of their cultural and spiritual past the Native Americans of California have an increased desire to collect, for ceremonial purposes, marine species that live in intertidal areas. In addition, there is an unknown number of Native Americans and other ethnic groups using the intertidal areas for subsistence gathering. The oiling of intertidal areas is covered in detail in Section IV.E.2.a.

Degrading the viewshed due to oil spills could change the National Historic Register criteria of a site, or could affect the religious or ceremonial significance to the groups who use the particular site.

Direct oiling of any sites or resources will cause damage due to the coating with the oil. This could interfere with dating methods and could disguise artifacts so they are not recognizable. The resources could be damaged or destroyed during cleanup operations depending upon the method of cleanup used. Additionally, cultural resource sites could be lost as a crisis atmosphere during the cleanup of an oil spill may preclude identification and avoidance of the site.

Beach fouling and surface slicks could result from chronic spillage. This would be relatively minor compared to the major accidents, but could be damaging to the cultural resources. The magnitude of these impacts would be comparable to those from the natural seeps. The overall imapct on the cultural resources would tend to be a degradation of the cultural resources at a particular site on a day-to-day basis, as is seen at present when the tar from the natural seeps impact the beaches in the Southern California area.

Onshore Facilities. All onshore surface-disturbing actions have the potential to destroy or disturb terrestrial prehistoric and historic sites. Activities with this potential include, but are not limited to, pipelaying activities, construction or expansion of support and processing facilities, and construction of temporary facilities for short-term projects.

Since State and local jurisdictions have primary authority over onshore development, it is assumed that their requirements for cultural resource protection will significantly reduce the likelihood of sites being disturbed or destroyed. There is always the possibility of undetected sites being destroyed during the construction process.

Offshore Structures. Offshore structures may impact the visual quality by intruding into the viewshed of onshore cultural resources. Visual impacts

to National Historic Register sites may occur if the introduction of intrusive or incongruent influences to the historic nature of the property changes the National Register criteria for the site. The visual intrusion of OCS development and exploration may impact the ceremonial and religious practice of Native American and other ethnic groups.

PROPOSED SALE AREA

Bottom Disturbing Activities. The bottom disturbing activities are anticipated to have a very low impact (No cultural resources likely to be present or disturbed.) as most of the shipwrecks in the area occurred close to shore, either off a point, harbor, or river bar (MMS Shipwreck File). Point Arguello has caused numerous wrecks and there is a potential for a moderate impact to historic resources if the anticipated pipeline is routed near the point. A low impact (Remote possibility of presence and disturbance of cultural resources.) is expected to cultural resources from the other pipeline which is anticipated to come ashore near Nipomo Mesa.

Oil Spills. One large oil spill is expected to occur in the Proposed Sale Area as a result of this proposal. If a spill occurs and contacts the shoreline, a temporary degradation may result, for the duration of the spill, to the viewshed of any historic or prehistoric sites in the contact area. The duration of the spill depends upon the size of the spill and the oil retention of the particular stretch of coastline. In the Proposed Sale Area the oil retention varies from several days at Point Arguello to over a year in Morro Bay (Woodward and Clyde, 1982).

Onshore cultural sites (see Section III.C.10) may be accidentally damaged or destroyed during the cleanup operations, and intertidal gathering areas may be fouled and rendered unusable as gathering areas. (The impacts to the intertidal areas are given in Section IV.E.5).

Submerged sites (see Section III.C.10) are not anticipated to be impacted by an oil spill unless the oil sinks and settles on the bottom, coating any artifacts which may be present. Oil spills, are expected to have a low impact to the cultural resources of the area.

Onshore Support Facilities. A very low impact is expected to the cultural resources in the area, as most facilities required for the development of the area will already be existing.

Offshore Structures. A very low impact on cultural resources in the Proposed Sale Area is anticipated from the intrusion of the five expected platforms into the viewshed of the cultural resources in the area. A moderate impact (significant possibility of both presence and disturbance of cultural resources.) is anticipated if the platforms are placed off Point Conception due to the Native American spiritual concerns.

AREAS OUTSIDE THE PROPOSED SALE AREA

Bottom Disturbing Activities. No bottom disturbing activities are proposed in the Santa Barbara Channel Area as a result of the proposal.

Oil Spills. One large oil spill is expected to occur in the Proposed Sale Area as a result of the proposal. There is a small probability that the spill will occur and strike the coast in the Santa Barbara Channel Area or northern Santa Maria Basins.

If a spill occurs and contacts the shoreline, a temporary degradation may result for the duration of the spill to the viewshed of any historic or prehistoric site in the contact area. The duration of the spill depends upon the size of the spill and the oil retention of the particular stretch of coastline. In the Santa Cruz Basin, the oil retention varies from several days at Pigeon Point to over a year in Elkhorn Slough (Woodward and Clyde, 1982).

Onshore cultural sites may be accidentally damaged or destroyed during the cleanup operations, and intertidal gathering areas may be fouled and rendered unusable as gathering sites. (The impacts to the intertidal areas are given in Section IV.E.2.a.)

Submerged sites are not anticipated to be impacted by an oil spill unless the oil sinks and settles on the bottom, coating any artifacts which may be present.

Any oil spill that occurs is expected to have a low impact to the cultural resource of the area.

If the expected spill contacts the Channel Islands or the Santa Barbara area, a moderate impact to the cultural resources in the area is expected. Cultural sites are known in the shallow areas along the coast, and the potential for impact exists.

Onshore Facilities. No onshore facilities are proposed outside of the sale area as a result of the proposal.

Offshore Structures. No offshore structures are proposed outside the proposed sale area as a result of the proposal.

Overall, a low impact to cultural resources is expected outside the proposed sale area as a result of the proposal.

ii. Conclusions: Low impacts (remote possibility of presence and disturbance of cultural resources) to cultural resources in Central California would be expected for the proposal. Localized moderate impacts (significant possibility of both presence and disturbance of cultural resources) could occur at Point Conception from offshore structures.

The impact to submerged resources is difficult to determine because of the lack of investigation for submerged resources undertaken in Central California.

An oil spill, if it occurs, may seriously impact the intertidal area (refer also to Section IV.E.3.a) and impact the subsistence and ceremonial gathering of Native Americans and other ethnic groups. The likelihood of oil spill related impacts is low.

iii. Cumulative Impacts: Impacts to cultural resources over the region occur both offshore and onshore from other projects and existing leases. The other projects include expansion of Vandenberg Air Force Base and the State Tidelands development. The Vandenberg expansion requires dredging at the old boathouse at Point Arguello, dumping of the dredge spoil offshore, and large onshore construction for roads, launch pads, and storage areas. All of these activities increase the potential impact to cultural resources. The State Tidelands development would have the same impacting agents as effect the OCS development, thus a low level of impact to cultural resources would be expected with development in State waters, except directly off Point Conception where a moderate impact would occur due to spiritual concerns of the Native Americans. The existing leases will have a similar expected level of impact in the region as the State Development.

k. Impact on Ports and Harbors

i. Discussion: The impacting agents that are associated with the proposal that may affect ports and harbors are: 1) additional vessel traffic (tankers, crew and supply boats), and 2) oil spills. The potential impacts that could occur as a result of these impacting agents are discussed below:

Vessel Traffic. Additional tankering and support vessel activity is expected to result from the proposed lease sale. The increased use of tankers to transport OCS crude oil into and out of ports (i.e., San Francisco Bay Area, and/or Gulf of Mexico Galveston), and the increased use of crew and supply boats would have an associated number of space-use conflicts within the ports and harbors. Vessels require a number of support facilities and berthing space. Displacement of some commercial fishing or industrial vessel berth space and support facilities is expected to occur, as competition for this space is already seen in some Central California ports and harbors. Alternative locations are not readily available and opportunities for expansion are limited. Expansion of existing ports and harbors is dependent upon consistency with Local Coastal Plans, Port/Harbor Plans, etc. Also refer to Sections IV.E.3.d (Coastal Land use) and IV.E.3.e (Commercial Fisheries).

These impacting agents could result in high impacts to ports and harbors (i.e. Port San Luis) in Central California. These impacts are expected primarily due to competition for vessel berth space and support facilities and the need for additional docks, berths, and facilities. See Appendix A for definitions of all impact levels.

Oil Spills. The probability that a large oil spill will occur and contact a port or harbor in Central California is very small (7 percent probability of contact with Port San Luis within 3 to 30 days; less than 2 percent probability of contact with all other ports or harbors in Central California). Therefore, no impacts as a result of oil spills are expected. In the unlikely event that an oil spill threatened a port or harbor, deployment of containment booms or other oil spill equipment could delay vessels from entering or departing the port or harbor.

PROPOSED SALE AREA

According to Transportation Scenario No. 1, twenty-five percent of the crude

oil produced in this Basin would be tankered from Gaviota to San Francisco, 25 percent would be tankered from Gaviota to the Gulf of Mexico (Galveston) and the remaining 50 percent would be transported from Gaviota via onshore pipeline to Los Angeles. Since Gaviota is located in the Santa Barbara Channel, potential impacts will be discussed in the "Areas Outside the Proposed Sale Area" section below.

Vessel Traffic. Additional support vessel traffic expected to occur as a result of selection of Alternative I is as follows: Crew boats will be used to transport personnel to and from wellsites or platforms either from Port San Luis or Gaviota according to Transportation Scenario No. 1. In the southern Santa Maria Basin, two trips per week per wellsite are predicted to be made during exploratory phases of the proposal. A similar number of trips would be made (per platform) during development and production. Supplies taken to the wellsites or platform would originate from Gaviota. Two trips per week (per wellsite or platform) are expected to be made by a supply boat during the exploratory, development and production phases.

Offshore infrastructure in the Santa Maria Basin expected to result from Alternative I includes 12 exploratory wells, nine delineation wells, and five platforms with 155 development wells. An assumed existing marine terminal would lie just offshore Gaviota. An assumed existing supply boat base would exist at Gaviota. A crew boat base would be built (Yamasaki, 1983) at Avila Bay (Port San Luis).

High impacts (i.e., requirement for additional docks, berths, and facilities) will occur to Port San Luis.

AREAS OUTSIDE THE PROPOSED SALE AREA

Impacts within the Southern California area are as follows.

Vessel Traffic. Twenty-five percent of the crude oil produced in the southern Santa Maria Basin would be tankered to San Francisco, 25 percent would be tankered to the Gulf of Mexico (Galveston) and the remaining 50 percent would be transported from Gaviota via onshore pipeline to Los Angeles, according to Transportation Scenario No. 1. A total of 39 round trips per year from Gaviota to San Francisco are expected to be made in the peak year of production (1993) by a 27,000 DWT tanker in Alternative I. This is based on an estimated peak oil flow rate of 21,075 bbl/day. The total distance traveled in this peak year by these tankers would be 23,088 miles. A total of eight round trips per year from Gaviota to the Gulf of Mexico (Galveston) are expected to be made the peak year of production (1993) by three 45,000 DWT tankers in Alternative I (i.e., 24 total round trips). This is based on an estimated peak oil flow rate of 21,075 bbl/day. The total distance traveled in the peak year by these tankers would be 211,200 miles. Additional support is as follows: Crew boats will be used to transport personnel to and from wellsites or platforms either from Port San Luis or Gaviota according to Transportation Scenario No. 1. In the Santa Barbara Channel, two trips per week per wellsite are predicted to be made during exploratory phases of the proposal. A similar number of trips would be made (per platform) during development and production. Supplies taken to the wellsites or platform would originate from Gaviota. Two trips per week (per wellsite or platform) are expected to be made by a supply boat during the exploratory, development, and production phases. Impacts to the assumed

existing Gaviota crew and supply boat base are not expected to be significant.

ii. Conclusion: High impacts to Port San Luis would be expected, primarily due to competition for vessel berth-space and support facilities. This competition would lead to the need for additional docks, berths, and facilities. The additional vessel traffic resulting from the proposal would only have a very low impact at the Port of San Francisco.

iii. Cumulative Impacts: Cumulative impacts to ports and harbors as a result of the selection of Alternative I, other projects (Section IV.D), oil spills from existing leases and import tankering, and future increases in space and use demands will create additional conflicts at the ports and harbors. Since exploration, development and production activity is a significant impact producing agent to ports and harbors, the proposal provides a substantial contribution to cumulative impacts to this resource category. The selection of Alternative I will lead to additional tankering and support vessel activity, and an associated number of space use conflicts.

The contribution of the proposal to the cumulative probability of oil spills occurring and contacting a port or harbor is very small, as discussed in the beginning of this section. The greatest contribution to the cumulative number of oil spills is from existing federal leases and import (Alaska or foreign) tankering. The probability that a large oil spill from existing federal leases and import tankering will occur and contact the opening of San Francisco Bay is 36 percent within 3 days and 44 percent within 10 and 30 days. The addition of proposal-related spills does not change these numbers. The numbers for Moss Landing are 3 percent within 3 days, 12 percent within 10 days, and 14 percent within 30 days. No spills from existing leases and import tankering are expected to occur and contact Port San Luis.

1. Impact on Marine Traffic

i. Discussion: Marine traffic refers to large commercial vessels which travel in California offshore waters. This traffic is bound to or from ports in California, Oregon, Washington, British Columbia, Alaska, the Gulf of Mexico, Japan, China, Singapore or other foreign ports. This traffic is composed of large vessels including tankers, container ships, freighters, dry bulk carriers, auto carriers, lumber ships, and passenger ships.

The impacting agents that are associated with the proposal that may affect marine traffic are: 1) additional vessel traffic (i.e., tankers, crew and supply boats, geophysical survey vessels), and 2) offshore structures (exploratory rigs, platforms, and subsea completion systems). The potential impacts that could occur as a result of these impacting agents are discussed below:

<u>Vessel Traffic</u>. Additional vessel traffic such as tankers, crew and supply boats, and geophysical survey vessels are expected to be used as a result of the implementation of Alternative I. When these vessels use or traverse traffic lanes which cross the proposed leasing area, potential conflicts could occur. These conflicts include collisions and vessel rerouting. Further conflicts arise when vessels do not adhere to traffic lanes.

Maritime military operations also occur throughout much of the proposed leasing area. In the event that hydrocarbon-related activities occur in military operating areas, further conflicts (i.e., collisions, vessel rerouting) could occur (see Section IV.E.3.o).

Proposal-associated collisions could result in a loss of human lives, personal injuries, property damage, and oil spills.

Offshore Structures. Exploratory drill ships, platforms, and subsea completion systems are expected to be used as a result of the implementation of Alternative I. Structures such as platforms could pose either a positive or negative impact to marine traffic. In a study conducted by the Transportation Systems Center, it was determined that 78 percent of all tanker vessel casualties in U.S. waters involving rammings, collisions, and groundings took place at night or during periods of reduced visibility (U.S. Dept. of Commerce, 1981a).

While reduced visibility has the potential of increasing the number of collisions between vessels and offshore structures, platforms could also provide a benefit for safe navigation due to navigational aids that are mandated by U.S. Coast Guard.

The U.S. Dept. of Commerce (1981a) conducted a computer simulated study of vessel movements around offshore structures in the Santa Barbara Channel. When structures were placed (simulation) near the border of a traffic lane, vessel operators often performed evasive actions which increased the risk of collision with other vessels. The risk was increased when structures were located on opposite sides of the traffic lane so as to form a "gated" configuration. The occurrence of such evasive maneuvers was considerably decreased by the placement of structures outside the 500 meter buffer zone, as well as when no permanent or temporary structures were placed within 1,000 meters of the boundary of the traffic lane for two miles either side opposite of the structure bordering the lane (U.S. Dept. of Commerce, 1981a).

The analysis that follows is based on McMullen (1977). Also refer to BLM (1980, 1981). In this duscussion, "casualty" is defined as an incident which could range from dents and scrapes to total loss of the vessel. "Severe casualties" could result in an oil spill, loss of life, or loss of the vessel.

Impacts to Central California marine traffic from proposal-related vessel traffic and offshore structures are expected to be low. Low impacts to this resource category means that vessel conflicts (i.e., collisions, rerouting) occur, but they are minor in character and are infrequent. (See Appendix A for definitions of all impact levels for this resource.) Assuming an average of 30 tanker round trips per year from Gaviota over the Proposed Sale No. 73 20-year development period, the statistically expected number of tanker casualties would be 0.05. A total of 0.01 severe casualties would be expected.

PROPOSED SALE AREA

According to Transportation Scenario No. 1, 25 percent of the crude oil produced in this basin is anticipated to be tankered from Gaviota to San Francisco, 25 percent would be tankered from Gaviota to the Gulf of Mexico (Galveston), while the remaining 50 percent would be transported from Gaviota via onshore pipeline to Los Angeles. Since Gaviota is located in the Santa

Barbara Channel, potential impacts will be discussed in the "Areas Outside the Proposed Sale Area" section below.

Vessel Traffic. Additional support vessel traffic expected to occur as a result of selection of Alternative I is as follows: Crew boats will be used to transport personnel to and from exploratory sites or platforms either from Port San Luis or Gaviota according to Transportation Scenario No. 1. In the Proposed Sale Area, two trips per week, per wellsite, are predicted during exploratory phases of the proposal. A similar number of trips would be made (per platform) during development and production. Supplies taken to the wellsites or platform would originate from Gaviota. Two trips per week (per wellsite or platform) are expected to be made by a supply boat during the exploratory, development, and production phases.

Proposal related tanker traffic emanating from Gaviota would cross the proposed sale area. A description of the volume of expected traffic and potential casualties is discussed in "Areas Outside The Proposed Sale Area", below.

Offshore Structures. Offshore structures in the southern portion of the Santa Maria Basin that are anticipated to result from the implementation of Alternative I include 12 exploratory wells, nine delineation wells, and five platforms with 155 development wells. An assumed existing marine terminal would lie just offshore Gaviota. An assumed existing supply boat base would exist at Gaviota. A crew boat base is anticipated to be constructed at Avila Bay (Port San Luis). Based on the presence of five platforms and a 20-year production period, the statistically expected number of platform-large vessel collisions would be 0.05. Therefore there is a 95 percent likelihood that there would be no collisions between vessels and platforms over the lifetime of the proposal.

Low impacts to marine traffic are expected to occur as a result of additional vessel traffic and offshore structures that are associated with the implementations of Alternative I.

AREAS OUTSIDE THE PROPOSED SALE AREA

At the present time, an average of ten large vessels per day arrive at the San Francisco Bay. Proposal-related tankering (peak year) would add about 3 percent to the present traffic that enters the Bay. This would include tankering from Gaviota to San Francisco Bay. No impacts to marine traffic north of San Francisco are expected.

Impacts within the Southern California area are as follows:

Vessel Traffic. According to Transportation Scenario No. 1, 25 percent of the crude oil produced in the Santa Maria Basin is anticipated to be tankered from Gaviota (within the Santa Barbara Channel) to San Francisco, 25 percent would be tankered from Gaviota to the Gulf of Mexico (Galveston) and the remaining 50 percent would be transported from Gaviota via onshore pipeline to Los Angeles. A total of 39 round trips per year from Gaviota to San Francisco are expected to be made in the peak year of production (1993) by a 27,000 DWT tanker in Alternative I. This is based on an estimated peak oil flow rate of 21,075 bbl/day. The total distance traveled in this peak year by these tankers would be 23,088 miles. A total of eight round trips per year from Gaviota to the Gulf of Mexico (Galveston) are expected to be made in the peak year of

production (1993) by three 45,000 DWT tankers in Alternative I (i.e., 24 total round trips). This is based on an estimated peak oil flow rate of 21,075 bbl/day. The total distance traveled in the peak year by these tankers would be 211,200 miles.

Additional support vessel traffic expected to occur as a result of selection of Alternative I is as follows: Crew boats will be used to transport personnel to and from wellsites or platforms either from Port San Luis or Gaviota according to Transportation Scenario No. 1. In the Santa Barbara Channel, two trips per week per wellsite are predicted to be made during exploratory phases of the proposal. A similar number of trips would be made (per platform) during development and production. Supplies taken to the wellsites or platform would originate from Gaviota. Two trips per week (per wellsite or platform) are expected to be made by a supply boat during the exploratory, development and production phases.

Assuming an average of 30 tanker round trips per year emanating from the western Santa Barbara Channel over the Proposed Sale No. 73 20-year development period, the statistically expected number of tanker casualties would be 0.05. A total of 0.01 severe casualties are expected. The probability of casualties would be highest in the peak year of production (1993) when 63 tanker round trips are predicted. The total number of casualties in the peak year would be 0.005; for severe casualties, 0.001.

Low impacts to marine traffic are expected to occur as a result of additional vessel traffic and offshore structures that are associated with Alternative I.

ii. Conclusion: Low impacts to marine traffic in the Central California and Santa Barbara Channel area would occur as a result of additional vessel traffic and offshore structures that are associated with Proposed Sale No. 73, Alternative I. Low impacts to the resource category means that vessel conflicts (i.e., collisions, rerouting) occur, but they are minor in character and infrequent.

The estimated number of vessel accidents during exploration, development, and production activities of the proposed sale should be small if current U.S. Coast Guard policy is followed. Presently, this policy does not permit surface hydrocarbon operations (drilling) within Precautionary Areas, safety fairways, or vessel traffic lanes.

iii. Cumulative Impacts: Cumulative impacts on marine vessel traffic as a result of the selection and implementation of Alternative I, other projects, (Section IV.D), and future increases in marine traffic, could result in more vessel-vessel and/or vessel-structure incidents. The potential for these incidents would be greatest in Central California and the Santa Barbara Channel where vessel traffic is the greatest. Moderate impacts (i.e., vessel conflicts occur frequently; rerouting of shipping traffic not necessary) are likely in Central California and the Santa Barbara Channel. Eleventh and Twelth Coast Guard Districts' recommended TSS modifications and additions (see Section III.C.12) would reduce the likelihood for these types of incidents.

The estimated number of vessel accidents during exploration, development, and production activities of the proposed sale should be small if U.S. Coast Guard

policy is followed. Presently, this policy does not permit surface hydrocarbon operations (drilling) within Precautionary Areas, safety fairways, or vessel traffic lanes. In the event hydrocarbon operations are permitted within the proposed vessel traffic lanes and precautionary area in the southern lanes and precautionary area in the southern Santa Maria Basin, potential impacts on shipping could be: high economic losses to the shipping and oil industries, loss of lives, and increased probability of a large oil spill.

Since exploration, development, and production activity is a significant impact producing agent to marine traffic, the proposal provides a substantial contribution to cumulative impacts to this resource category.

m. Impact on Refineries

i. Discussion: The impacting agent, associated with the proposal that may affect California refineries is sour (high sulfur) and heavy (low API) crude oil. Several processes are required to turn this quality of crude into a saleable product. These processes include catalytic hydrocracking, fluid catalytic cracking, delayed coring, fluid coring, flexi-coring and pyralisis. Impacts to the refineries would occur when the plant is not equipped to process low quality crude oil.

California refineries have the capacity and would process all of the Proposed Sale No. 73 crude oil that is shipped or piped to them (Yamasaki, 1983). No new refineries are proposed or expected. Unless Proposed Sale No. 73 crude oil is beyond the refineries' limiting factors, there should be no impact on the refineries. However, Proposed Sale No. 73 crude oil is expected to be relatively sour (high sulfur) and heavy (low API). Therefore, this quality of crude oil would represent a partial contribution to the need for expensive modifications to the refinery processes. The cost of these modifications is estimated to be from $10 million to $800 million per refinery (1982 dollars). On a local and worldwide basis, the quality of oil is also decreasing. Furthermore, the South Coast Air Quality Mangement District has proposed (in draft form) an air quality management plan which would require modifications to refineries by 1987. (See Sections III.A.9 and IV.E.l.c for further details.) Thus, in the future, refinery modifications will need to be made to handle lower quality crude oils.

The trend towards refinery modificaitons is evident in California (see Yamasaki, 1983 for details). Recently, Shell Oil Co. started the first phase of an $800 million program to modernize its U.S. West Coast refining system (Oil and Gas Journal, September 13, 1982). Union Oil Co. is also modifying their Los Angeles refinery.

Low impacts to California refineries are expected as a result of the proposal. Low impacts are defined as follows: Proposed Sale No. 73 crude oil is expected to represent a partial contribution to the requirement for expensive modifications to the refinery process. See Appendix A for a definition of all impact levels for this resource.

PROPOSED SALE AREA

Proposed Sale No. 73 crude oil is not anticipated to be handled at refineries in the proposed sale area (Yamasaki, 1983). Therefore, there would be no

proposal-related impacts to refineries in this area.

AREAS OUTSIDE THE PROPOSED SALE AREA

A portion (about 25 percent) of the crude oil that is produced from the proposed sale area would be tankered to the San Francisco refineries. This crude is expected to represent a partial contribution to the need for modifications to the refining process. This is considered to be a low impact to individual refineries in this area.

A certain amount of crude oil from the proposal is expected to be transported to the Los Angeles area refineries. This crude is expected to represent a partial contribution to the need for modifications to the refinery process. This is considered to be a low impact to individual refineries in the Los Angeles area.

ii. Conclusions: California refineries have the capacity and would process all Proposed Sale No. 73 crude oil that is shipped or piped to them. Therefore, there would be no need for new refineries to be constructed. However, it is expected that most of the Proposed Sale No. 73 crude oil would be heavy and high in sulphur content. This quality of crude would contritute to the need for expensive modifications (i.e., retrofitting) to the refinery process. The cost of these modifications is estimated to be from $10 million to $800 million per refinery (1982 dollars). This is considered to be a low impact to individual refineries. That is, Proposed Sale No. 73 crude oil is expected to represent a partial contribution to the requirement for expensive modifications to the refinery process.

iii. Cumulative Impacts: Cumulative impacts on refineries as a result of the selection of Alternative I, other projects (Section IV.D.), and future increases in oil production would result in moderate impacts to refineries. These impacts are defined as a major contribution by future crude oil production to the need for expensive modifications to refineries.

n. Impact on Offshore Structures

i. Discussion: This resource category includes platforms, subsea pipelines, exploratory drill ships, SALMs, OS&Ts, and marine terminals. These structures are located in both State and Federal waters. As discussed in Chapter III.C.14, the only existing offshore structures in Central California are exploratory drillships in the southern Santa Maria Basin, marine terminals located between Monterey Bay and Avila Bay (refer to Visual No. 2, BLM, 1980), and the subsea pipelines which are associated with the terminals. An abundance of structures are concentrated in the Santa Barbara Channel (see Transportation mini-visual, BLM, 1981a).

The impacting agents that are associated with the proposal that may affect existing offshore structures are: 1) platform and pipeline installation activities, and 2) additional vessel traffic (refer to IV.A.5 and 6). The potential impacts that could occur as a result of these impacting agents are discussed below:

Platform and Pipeline Installation Activities. Existing subsea pipelines could be impacted by the anchoring activities of pipeline installation barges and the

smoothing of anchor scars by dragging chains or bars along the ocean bottom. Since barge operators are made aware of the presence of subsea pipelines, the likelihood that these types of impacts would occur is very low. Barge operators exercise extreme caution when such activities take place near subsea pipelines.

Vessel Traffic. Vessel traffic such as crew and supply boats and tankers will be traversing offshore areas of exploration and development and could interfere with existing offshore structures. Additionally, seismic boats will also be operating in these areas. During periods of adverse weather conditions (e.g. storms or dense fog), there will be an increased risk of collision with existing structures. Such incidents could result in oil spills, loss of human lives, and loss of equipment. However, the probability is very low that these events would occur in Central California.

Collisions between small vessels, such as crew boats or supply boats, and platforms, represent little structural risk to the platform because of the disparity in size (National Research Council, 1981). While these small vessels are the ones most likely to be involved in collisions with offshore installations, the risk of collisions between large ships and offshore installations is growing commensurate with the increase in offshore activity, as evidenced by the proliferation of offshore installations and higher volumes of marine traffic. From an engineering standpoint, it is impractical to design a platform to be able to withstand head-on impact from a moving ocean-going vessel. The only procedure that can eliminate the risk of collision is to ensure that vessels do not operate in areas of offshore platforms. As platforms have evolved through the years, they have gradually become larger, heavier, and stronger. As such, while not able to withstand a collision from a ship, today's platforms have reached the point where as the result of the collision the ship also withstands major damage. Due to this fact, ship operators appear to be exercising more caution than in the past when operating in areas of offshore oil and gas activity (National Research Council, 1981).

PROPOSED SALE AREA

Subsea pipelines which are associated with marine terminals near Morro Bay and Port San Luis could be impacted as described above. However, it is unlikely that these impacts would occur. Therefore, no impacts are expected to existing offshore structures in this basin.

AREAS OUTSIDE THE PROPOSED SALE AREA

Although subsea terminals are associated with marine terminals in Monterey Bay, no impacts are expected to occur due to exploration and development activities being restricted to the proposed sale area.

Impacts within the Southern California area are as follows:

Vessel Traffic. Structures in the Santa Barbara Channel include platforms, subsea completion systems, pipelines, an offshore separation and treatment (OS&T) vessel, and exploratory rigs. Impacts to these existing oil and gas structures will occur in the Santa Barbara Channel as a result of additional vessel activity from the proposal (Alternative I). Low impacts from additional vessel activity are expected to occur to offshore structures within this channel.

ii. Conclusion: Impacts to offshore structures will be confined to the Santa Barbara Channel. These impacts are expected to be low (affected structures could be repaired, with little, if any, replacement; down-time would be only one or two days).

iii. Cumulative Impacts: Cumulative impacts to offshore structures as a result of the selection of Alternative I, other projects (Section IV.D.), future oil and gas infrastructure, and increased vessel support traffic, will add additional conflicts at the offshore structures. Impacts to these structures in the Santa Barbara Channel would be the greatest due to the high level of hydrocarbon activities in the area, etc. Low impacts are expected to occur, although the likelihood that these impacts will occur is high.

o. Impact on Military Uses

i. Discussion: The military is very active offshore Central California, utilizing approximately 87 percent of the Proposed Sale No. 73 area. The military activities include fleet maneuvers, flight training and testing, missile and bomb testing, submarine transit lanes and diving areas, anti-submarine warfare operations, and dumping grounds. The military agencies involved are the Navy and the Air Force. The military operating areas are the same as were in effect during the preparation of the Sale No. 53 EIS (1980a) (Foster, 1982; Abbott, 1982; personal communications) and are illustrated in Visual No. 1 of that document). Offshore oil and gas activities have the potential to impact military operations because of space -use conflicts resulting from increased vessel traffic, the placement of permanent and semi-permanent drilling and production structures, and activities stemming from oil spill cleanup efforts. These impacting agents are discussed below.

Impacting Agents. Most of the current military operations require "exclusive-use" areas with large safety zones or "joint-use" areas with many precautions and extensive scheduling, for hazardous and critical operations. As oil and gas activities are opened up and expanded in Central California, additional space-use conflicts are created with the military.

Vessel Traffic. Offshore oil and gas activities result in extensive traffic of service and support vessels. These include crew and supply boats and helicopters. Additionally, as oil and gas activities increase, other OCS users such as fishing vessels will also be displaced adding pressure to use the military operating areas. All these vessels will force the military to increase the surveillance and clearing efforts of an area prior to hazardous military operations. This will create extensive time delays and significantly increase the risk of a major accident where human lives could be lost. Current military operations would have to be reduced or shifted significantly to accommodate this additional OCS usage. The impacts to military activities are expected to be high (significant alterations or reductions of military activities would be required) as a result of this increased vessel traffic.

Structure Placement. The placement of permanent and semi-permanent structures on the OCS is a significant part of oil and gas activities. This would eliminate that part of the OCS from military operations for up to the expected

production life of the proposal (25 years), forcing the curtailment or shifting of current military operating areas. If alterations were not made, the risk of a life-threatening accident would be greatly increased. The impacts to military activities are expected to be high as a result of the placement of offshore structures, including five permanent platforms ("most likely" case).

Oil Spills. The Oil Spill Risk Analysis Model predicts only one spill as a result of Proposed Sale No. 73. Overall, this is expected to have no impact on military operations. However, if a spill did occur in or near an area used by the military, impacts would be high. This would be the result of heavy traffic in the area of the spill from cleanup efforts, forcing the postponement of operations in the area until the completion of the cleanup efforts.

PROPOSED SALE AREA

The military operations in this area include flight training, missile and bomb testing from nearby Vandenberg Air Force Base, dumping (see Section IV.E.1.b), and submarine transitting. The expected impacts are high (significant alterations to military activities would be required) as the military operating areas overlap a large amount (approximately 87 percent) with the Santa Maria Basin area being considered for leasing.

AREAS OUTSIDE THE PROPOSED SALE AREA

There will be no impacts expected to military operations outside the sale area (such as the northern portion of the Santa Maria Basin and the Santa Barbara Channel) as a result of the Proposal.

ii. Conclusions: Without the Military Stipulation, the overall impacts expected to military operations would be high (significant alterations or reductions to military operations would be required) as substantial overlap of military operating areas and the Proposed Sale No. 73 area exists (87 percent in southern portion of the Santa Maria Basin). However, these impacts would be adequately mitigated with invocation of the Standard Military Stipulation.

iii. Cumulative Impacts: The cumulative impacts expected to military activities will remain high (significant alterations to military operations would be required). This is because the existing leases in Central California are located in the Santa Maria Basin and already have the standard military stipulations attached to them, which adequately mitigates any impacts to military operations. Impacts from other OCS related activities including expansion of port facilities (such as Pt. Hueneme), increased fishing conflicts, Space Shuttle flights and the MX Missile project at Vandenberg AFB, and the proposed LNG facility at Pt. Conception, are not expected to change the impact level significantly.

F. Environmental Impacts of Alternative II - Modify the Sale to Protect Sensitive Biological Areas

Adoption of Alternative II would create a 10-mile protection zone centered on Morro Bay. Alternative II would modify the proposal (Alternative I) by deferring three tracts and portion of four tracts from Proposed Sale No. 73. See Section II.A.2. for a more detailed description of the protection zone.

Morro Bay is considered one of the largest bay wildlife habitats on the California Coast. The area is also used extensively for recreation, hunting, sport and commercial fishing. At low tide, approximately 1,400 acres of tidal mud flats are exposed. (NOAA, 1982). The tidal flats, salt marsh, and adjacent habitats of Morro Bay provide an extensive feeding ground for various species of shore birds and waterfowl. Five endangered or threatened species utilize the bay or adjacent habitats. The upper edges of the tidal mud flat are also rich in invertebrate species. The shell fishery resources support a commercial oyster farm in addition to a very large recreational clam and ghost shrimp shell fishery.

If this Alternative is selected, expected impacts on the Physical, Biological, and Socioeconomic Environment would essentially remain the same as those impacts identified with the proposal, i.e., low or very low. Although there is a slight reduction in acreage, no change is assumed for the resources or the development and transportation scenarios. Thus, one spill is expected through the adoption of Alternative II. This oil spill is not expected to contact land near Morro Bay.

However, eliminating tracts through selection of this Alternative would reduce the potential for impacts to this area by 1) ensuring there is sufficient time for cleanup, containment and weathering should an OCS platform spill occur, and 2) ensuring visual impacts would not exceed a low level due to platform placement.

1. Cleanup, containment and weathering. The 10-mile protection zone would allow a) 12 hours for oil spill cleanup equipment to be deployed in 20 knot winds before oil reaches shore allowing possible diversion of the oil, and b) 12 hours for oil spill cleanup equipment to be deployed and 5 hours for cleanup activities in 15 knot winds before oil reaches shore. The U.S. Coast Guard and MMS Memorandum of Understanding concerning oil spill cleanup requirements require cleanup activity capabilities to take 6-12 hours, weather permitting. Twenty (20) knot winds occur out of the NW, W, and SW, approximately 8-12 percent of the time (approximately 18 percent in April-June) and 15 knot winds occur out of the NW, W, and SW approximately 30 percent of the time.

   In many cases, the best way to protect a shoreline from oil impacts is to disperse the oil at sea with the use of chemical dispersants. If dispersants are to be used, they probably should be applied before oil comes within 5 miles of shore (Lindstedt-Siva, 1977). The 10-mile protection zone

that this Alternative would establish would allow 6 hours in 10 knot winds and 8 hours in 15 knot winds to apply dispersant before oil comes within 5 miles of shore.

The elimination of these tracts would also increase the time that the oil, moving directly toward shore, would reach the shore (approximately 12 hours). During this time, a significant amount of evaporation, dissolution and weathering of oil would occur, reducing the quantity and toxicity.

2. Platforms placement. Platforms placed at least 10 miles from shore will be only marginal visibility from Morro Bay especially during much of the year when fog or mist is present.

The following resource categories would have reduced potentials for impacts with adoption of this Alternative.

Estuaries and Wetlands. In the event an oil spill occurs and contacts Morro Bay, high to very high impacts could result. If a large spill covers the surface of the tidal mud flats and remains for several days, significant interference with the ecological relationship (feeding and breeding grounds) lasting over 10 years could result. Some species within the estuaries, if endemic, may be permanently eliminated. With the adoption of the Alternative. the likelihood of potential impacts from oil spill resulting from the proposal contacting Morro Bay would be reduced.

Endangered and Threatened Species. The southern sea otter, California brown pelicans, American peregrin falcon, salt marsh harvest mouse and Morro Bay kangaroo rat utilize the Morro Bay area. Under the proposal, none of these species are expected to experience significant impacts since oil spills are not expected to contact significant habitat. However, in the event of a spill entering Morro Bay, the most likely impacts to the species or California populations would be as follows: southern sea otter - low, brown pelican - very low or low, peregrin falcon - low, salt marsh harvest mouse - moderate or high and Morro Bay kangaroo rat moderate or high. Low impacts would likely mean mortality to a few percent of the species or California population with recovery requiring a few years. Moderate to high impacts would mean up to 25 percent mortality to the species and recovery requiring several decades.

If oil can be prevented from entering the area by booming, containment or dispersants, these impacts could be reduced to insignificant.

Commercial Fisheries. The shell fishery resource of Morro Bay support a commercial oyster farm. If a large oil spill contacts this area, fishermen could sustain moderate economic losses for about one month. The likelihood of this impact occurring would be reduced with the selection of this Alternative.

Visual Resources. The impacts from offshore platforms on Visual Resources off Morro Bay were based on the Grannille Corporation Study (1981). The impact levels were determined by the expected change in the aesthetic resources of the area based on OCS development. In the study platforms were assumed to be 3 miles offshore. Impacts to visual resources in the Morro

Bay area would be low. With the selection of this Alternative, platforms would not be constructed within the deleted area. This Alternative would ensure impacts would not exceed the expected level.

If an oil spill contacts the shoreline, an additional degradation to the visual quality of the bay would occur. This degradation would remain until cleanup operations are accomplished by either man or natural processes. If a spill contacted Morro Bay, a high impact would be expected. With the selection of this Alternative, the likelihood of a spill from the proposal contacting the bay would be reduced.

G. Environmental Impacts of Alternative III - Delay the Sale

The impacts of a Delay the Sale Alternative would postpone the impacts described in Section IV.E. until such time as the sale is reinstated. Refer to Section II.A.3 for a complete description of this alternative.

Postponement of the Proposed Sale No. 73 would result in delay in the exploration, development, and production of oil and gas resources. Any economic or national security benefits which could be attributed to the domestic production of hydrocarbons in these amounts would be postponed.

A delay of the Sale may not change any of the impacts assumed to occur as a result of Proposed Sale No. 73. It would most likely postpone their occurrence. However, improvements may occur in technologies for oil spill prevention and recovery, deepwater drilling and production techniques for oil spill prevention and recovery, deepwater drilling and production techniques, or for exploration and production in hostile environments which may lessen the risk of some adverse impacts. Also, new informatin on oil and gas resources may become available from drilling on adjacent existing leases and the economic feasibility of developing an area will probably improve.

Another reason for delaying Proposed Sale No. 73 could be to obtain additional information within the proposed sale area. Additional information from on going or future studies will enhance the knowledge of the environment and efffects of OCS activities. However, without a delay of the Sale, the studies information will, become available for use in evaluating exploration strategies and in developing production plans. In addition, as existing and future oil and gas development (Federal and State) occurs within the area. Impacts from these activities would provide additional information for cumulative analysis.

H. Alternative IV - No Sale

This alternative removes the total area for proposed leasing at this time. All potential physical, biological, and socioeconomic impacts resulting from hydrocarbon exploration and development from Proposed Sale No. 73 would be eliminated at this time.

Although cancelling Proposed Sale No. 73 would eliminate all the impacts that are expected as a result of the proposal, within the region would still result from existing oil and gas activities from the previous OCS Sale No. 53, the State Tidelands leasing and development (refer to Sections IV.C.3 and D.4) and future OCS Lease Sales in this area, as well as, the importation of oil via

tankers to refineries in the area (see Section III.C.13).

Changes to the Physical, Biological and Socioeconomic resources over the next 25 years without the proposal and future OCS Lease Sales, would still occur. Population expansion and associated impacts will continue, and would be directly or indirectly responsible for most problems and benefits associated with non-oil related changes in Central California. For a more detailed discussion on the future of Central California without the proposed sale and future sales, refer to Section IV.H.

1. Physical Environment

Water Quality. Water quality will still continue to degrade in several bays and estuaries due primarily to agricultural runoff. San Francisco and Morro Bays may experience decreased water quality due to industrial, power plant, or domestic sewage effluents which will increase with increasing populations. Those water quality decreases may be balanced in part by improved secondary sewage treatment required by the EPA. Contributions of trace metals (e.g., lead) to the ocean near major urban areas will continue due to automobile and industrial combustion of fossil fuels and subsequent aerial washout.

Dump Sites. New dump sites will be designated as their need arises, and positioning of these sites will be in areas of least potential environmental impact. Deterioration of the water quality will occur temporarily and locally at each of the dump sites; however, overall there will be minor changes. The impacts from the dump sites are expected to remain at present levels.

Air Quality. If the Proposed Sale No. 73 were not to take place, the air quality impacts described in Section IV.E.1.c would not occur. Future impacts from existing leases in the Santa Maria Basin would be low. Future pollution levels would not be expected to change significantly. Many coastal areas would continue to experience episodes of ozone concentrations exceeding State or Federal Standards. However, with increasingly stringent pollution control strategies being implemented by the Air Pollution Control Districts, ozone levels should gradually decline in the future. Overall air quality should remain at a constant level or perhaps experience a slight decrease.

2. Biological Environment

Intertidal Benthos. With the expected population expansion and development along the coast of Central California, some corresponding impact to the intertidal environment is expected. Although the rate of degradation will be decreased due to State and local commitments and legal mandates, the amount is nonquantifiable and unpredictable except in general terms.

Increased visitor use of intertidal areas for food gathering or walking, collecting, overturning rocks, etc., will have detrimental effects on certain areas where use is highest. Municipal sewage near coastal cities or oil spills from tankering from Alaska and foreign sources, particularly near San Francisco, will cause additional impacts to certain areas.

In the Santa Maria Basin, impacts could result from previously leased OCS sales (particularly Sale No. 53), State of California leases in State Tidelands, Pt. Conception LNG accidents, sewage facilities resulting from the expansion

of Vandenberg Air Force Base or other cities in the area.

Further impacts are possible from import oil tanker accidents, previous OCS sales and State of California Tideland leases.

Subtidal Benthos. The principal non-oil effects to the subtidal benthos will come from pollution and waste disposal. Most of these impacts will be localized near cities, but the magnitudes of the impacts are difficult to predict.

Fish. Without the proposal, fish populations in California are expected to decrease due to fishing pressure, sewage disposal, existing offshore oil and gas leases (State and Federal), new State leases proposed to be sold between Point Arguello and Point Conception, tanker transportion of foreign and Alaskan crude oil imports, and other vessel traffic (see Sections I.C, III.C.5, III.C.6, III.C.12, IV.A.4, IV.C.3, and IV.D for descriptions of these actions).

Fishing pressure probably is the most important stress on fish populations causing large to very large decreases in many fish populations. Oil spills are expected to cause a moderate reduction in slamon populations lasting 5 years or more, a moderate reduction in Pacific herring poplulations lasting 3-5 years, and a small 1-2 year reduction in northern anchovy and squid populations (See Sectin IV.E.2.c).

The cumulative effect of all of these stresses on fish populations, particularly fishing pressure, is expected to cause large to very large decreases in fish populations.

Marine Mammals. Without the proposal marine mammals will suffer impacts from several sources over the next 25 years. Sewage, increased tanker and recreational traffic, existing hydrocarbon leases, expanding population centers along the coast, changing climatic conditions and other natural causes may change marine mammal distributions. However, most whales and pinniped numbers are increasing annually and should continue to do so. The status of the Southern Sea Otter is questionable. Until it is determined whether the population is still increasing or is decreasing predictions are impossible.

Without the proposal, some species are expected to suffer moderate to high reductions in local populations. Some species may suffer a general degradation in health due to pollutants. Overall, the impacts are expected to be low to moderate in both the positive and negative direction. Population numbers are expected to increase; however, general levels of health may be slightly reduced.

Seabirds. Without the proposal, seabirds will suffer impacts from several sources over the next 25 years. Sewage, increased tanker and recreational traffic, existing leases (Satae and Federal), expanding population centers along the coast and changing climate conditions may reduce seabird distribution and populations. However, with increased conservation efforts it is possible many of these effects can be reduced.

If pollution levels remain constant or increase, some species may suffer low level impacts from several sources and a general degradation of health is possible. Overall, the impacts are expected to be low to moderate; that is,

some individuals may die but most species are expected to maintain viable populations.

Endangered and Threatened Species. Without the proposal, Endangered Species will suffer impacts form several sources over the next 25 years. Sewage disposal, increased tanker and recreational traffic, expanding population centers along the coast, changing climatic conditions or other natural changes, and existing OCS leases may cause changes in species abundance and distributions. Some species such as brown pelicans, least terns, peregrin falcons and bald eagles seem to be recovering. Their biology is reasonably well understood and it is expected recovery should continue. Other species such as the rails are secretive animals and little of their habitat remains. Their future is much more tenuous. The survival of some populations of the Endangered whales is also in question. The status of the southern sea otter is also in question and oil spills form foreign tankering are always a serious threat. Overall it is expected some species will increase in numbers and distribution. Others face extinction over the next 25 years.

Estuaries and Wetlands. With the predicted population expansion and development near wetlands, some corresponding degradation to these areas is expected. Although the rate of degradation will be decreased due to State and local commitments and legal mandates, the amount is nonquantifiable and unpredictable except in general terms.

If the no sale alternative is chosen, oil related impacts to estuaries and wetlands could come from oil import tanker accidents, particularly in the Bodega Basin near San Francisco. In Santa Maria Basin further impacts could come from OCS Sale No. 53 and State of California Tideland leases. The estuaries most sensitive to these activities are Morro Bay and the San Luis Obispo Creek.

Areas of Special Concern. The above discussion of intertidal benthos can be applied here since most of the Sensitive Biological Areas are intertidal areas. Whether these protected areas will be degraded or upgraded in the future will primarily depend upon the quantity and quality of domestic pollution, enforcement and prevention of intertidal collecting, and reduction of the amount of human traffic allowed on the sensitive areas.

The largest impact from tanker import spills, or previous OCS or future State oil activity will depend upon the number, quantity and frequency of spills reaching the sensitive areas. Although unpredictable, except in the most general terms, one can estimate that areas having the greatest amount of oil development, coupled with high oil spill hit probabilities based on the oil spill model, will have the largest potential for oil spill impact from previous oil leases. Based upon these considerations, the areas of greatest oil spills concerns are: Channel Islands National Park in Southern California, Farallon Islands, Point Reyes Headland Reserve, Duxbury Reef Reserve near San Francisco, and Julia Pfeiffer Burns Underwater Park in the Santa Maria Basin.

Pt. Reyes/Marine Sanctuaries. If the No Sale Alternative is chosen, parts of the Point Reyes/Farallon Island Marine Sanctuary will be affected from pollution contained in the outflow of San Francisco Bay. Both the sanctuary and Point Reyes Seashore could be impacted by import oil tanker accidents.

Oil spills resulting from tanker accidents or previous OCS or state oil sales have a high probability of occurring and contacting the Channel Islands National Marine Sanctuary in Southern Califiornia (BLM, 1975 and 1979). Impacts to marine birds and mammals, intertidal and shallow water subtidal benthos will range from low through high from an oil spill. Consult the appropriate sections for discussions of the impacts for the specific biological resources.

3. Socioeconomic Environment

Coastal Economy. Selection of this alternative would eliminate the economic impacts described in Section IV.E.3.b. Realization of the economic and national security benefits expected to result from Proposed Sale No. 73 would be foregone. All regional increases in economic activity expected to occur as a result of the proposal would be eliminated, including expected increases in employment.

Without Proposed Sale No. 73, the study area is expected to experience a significant increase in the labor force and general economic activity. The labor force in the study area is projected to icnrease by 60.08 percent during the project period. However, the average increase in the labor force would be 1.18 percent per year of the base. Table IV.H.3-2 shows projected increases in the labor force for Sale Area during the study period. The labor force is expected to increase by 60.1 percent between 1980 and 2010.

Total earnings for the sale area is projected to increase by 279.5 percent during the project period. This represents a 3.39 percent gain per year, a moderate economic growth rate for the total sale area. Table IV.H.3-3 shows projected growth of selected economic components for the sale area during the study period.

Demography. Selection of this alternative will result in the removal of all impacts associated with Alternative I. However, the study area is expected to have a large increase in population between 1980 and 2020. Population is expected to increase by 78.3 percent or an annual increase of 1.46 percent. The additional population is expected to result in an increased housing demand, reduced household size, and reduced rate of home ownership. Table IV.H.3-1 presents information on population changes expected between 1980 and 2020.

Public Services and Facilities. Increases in population of Central California, as projected by the State of California, will stress public services and facilities with or without the proposed action. Population growth will continue to stress existing water supply along the entire coast. Pumping from wells will continue overdrafting the water table which may lead to lowering of the water table, salt water intrusion, and subsidence. This will result in requiring construction of new facilities, strict conservation measures and major water transportation projects.

Impacts from projected population growth will stress existing waste water treatment facilities, result in more frequent and greater numbers of septic tank failures and create waste residue disposal problems. These impacts may occur at different times along the coast depending upon the status of the existing treatment facilities. Transportation systems are adequate in most areas and can accommodate some increase. Future population growth may stress these systems (roads, airports, railroads) further in the future with road

TABLE IV.H.3-1
HISTORIC AND PROJECTED POPULATION BY DECADE 1980-2020

	1980*	1981**	Percent Change	1990+	Percent Change	2000+	Percent Change	2010+
Central Coast								
Monterey	290,444	294,600	1.43	356,400	20.98	409,300	18.16	465,200
San Luis Obispo	155,345	158,900	2.29	181,800	14.41	216.100	18.87	251,500
Santa Barbara	298,660	299,500	0.28	339,400	13.32	372,900	9.87	401,000
Santa Cruz	188,141	191,300	1.68	248,300	29.80	309,700	24.73	375,200
Subtotal	932,590	944,300	1.26	1,125,900	19.23	1,308,000	16.17	1,492,900

*U.S. Census
**California Department of Finance
+California Department of Finance
Report 77-P-3 (December 1977)

TABLE IV.H.3-2

PROJECTED LABOR FORCE FOR
CENTRAL CALIFORNIA

1980	1990	2000	2010
339,090	409,377	475,589	542,818

Source: MMS Estimates, 1982.

TABLE IV.H.3-3

SELECTED ECONOMIC COMPONENTS FOR THE TOTAL SALE AREA
(in thousands of 1980 dollars)

Economic Component / Year	1980	1985	1990	2000	2020
Transportation	6,109,382	7,271,962	8,532,863	11,855,778	20,964,673
Wholesale/Retail	10,846,366	12,578,655	14,588,101	19,869,620	33,084,281
Housing	4,478,430	5,462,423	6,663,098	9,825,355	18,770,127
Services	13,556,231	17,021,302	21,372,632	32,997,900	67,492,890
Total Earnings	68,036,095	81,266,550	97,070,387	138,427,609	252,690,694

Source: Obers Projections, 1972.
U.S. Water Resources Council, Wash., D.C.

systems being subject to the most stress the earliest. Airports and railroads should be able to accommodate most increases. Power generating facilities are adequate for current and near future needs. Long term population growth may require construction of new plants.

The local, county and State governments are seriously hampered in providing for these future needs by the effects of Proposition 13. Funds for public services and facility construction or improvement are very limited, Federal funding is also less. Serious impacts to services and facilities may occur sooner than expected because of local governments' inability to deal with the need for improvements or new facilities.

Requirements of the Clean Water Act to end ocean or stream dumping or treated wastes in 1985 will cause further stress on existing systems.

Coastal Land Use. Pressure for changes in land use and in demand for housing will exist in Central California without the proposal. Projected population growth using State of California figures will create a demand for intensive land use. Commercial and industrial growth will create a demands for rezoning of existing land use. The demand and need for affordable housing will continue. Overall all types of housing will continue to be in demand form the increasing population. Local jurisdiction will have to deal with growth induced demands through Local Coastal Programs, Port Master Plans, and City and County General Plans.

Commercial Fisheries. Without the proposal, California commercial fishermen are expected to sustain economic losses due to natural fluctuations in fish and shell fish populations, competition with other fishermen, changes in market conditions, restrictions on fish harvests, existing offshore oil and gas leases (State and Federal), new State leases proposed to be sold between Point Arguello and Point Conception, tanker transportation of foreign and Alaskan crude oil imports, and other vessel traffic (see Sections I.C., III.B.1, III.B.2, III.B.3., III.C.5., III.C.6., III.C.12., IV.A.4., IV.C.3, and IV.D for descriptions of these actions).

Natural fluctuations in fish and shell fish populations, competition with other fishermen, changes in market conditions and restrictions on fish harvests probably are the most important stresses on commercial fishermen. Fishermen unable to find fish and shell fish or find a market frequently suffer high economic losses and some may be forced out of business.

Oil spills from existing leases, proposed leases, tanker transportation of foreign and Alaskan crude oil imports and other vessel traffic potentially could also be an important stress.

The cumulative effect of oil from all of these sources is expected to result in 1) a moderate economic loss to commercial salmon fishermen due to a reduction in salmon stock for 5 years or more, and 2) a moderate economic loss to other commercial fishermen since fishermen probably will be prevented from leaving port by oil containment booms during the period that a large oil spill hits shore. (See Section IV.E.3.e).

Many manmade structures exist or are expected to be placed in California waters as a result of existing offshore oil and gas leases (State and Federal) and

proposed leases (State) (See Sections VI.C.3 and VI.D.4). A small number of temporary abandonments and debris exist or are expected in these areas. The cumulative impact of all of these structures is expected to cause a moderate economic loss to trawl fishermen for at least 3 years since nnot all problems have been resolved with at least one existing pipeline in the Santa Barbara Channel, and it is possible that similar problems may occur with another pipeline when laid. (See Section IV.E.3.e).

Vessel traffic from existing and proposed leases, tanker transportation of foreign and Alaskan crude oil imports and other ships usually create low navigational hazards to fishing. Geophysical vessel operations from existing and proposed leases cause a small amount of fishing gear loss.

The cumulative effect of all of these stresses, particularly non-OCS related stresses, is expected to cause high economic losses to the commercial fishing industry.

Sportfishing. Public participation in sportfishing is expected to increase slightly without the proposal. Limited transportation to fishing is the major restraint on continued growth. sportfishing will be subjected to natural fluctuations in fish and shellfish populations.

Recreation. Recreation will continue to grow in the absence of Proposed Sale No. 73, but will continue to risk impact from sources such as municipal sewage, regulated access, and rising costs. The expected change in recreational activities without the proposed sale would still be an increase in amount of participation and construction of facilities. This is due to more time being available to people for leisure activities. The restraints on this growth are available cash and availability of gasoline, and this would tend to have people utilize facilities closer to their towns than are presently used.

Tourism. California is the major vacation destination in the United States, thus tourism is anticipated to continue to increase in the future. At the present time the economic situation in the country has reduced the overall availability of discretionary income. If this continues, the increase in tourism will not be as great as has been seen in the last several years.

The availability of gasoline will also affect the tourist industry, with a reduction in supply causing a drop in tourism similar to that seen in the 1974 to 1979 gasoline shortages.

Visual Resources. Without the proposal, the expected change in the visual resources of the area will be relatively minor, and restricted primarily to increases in residential development along the backshore, and the development of recreational facilities along the shore. This will tend to cause a slight reduction in the quality of the visual resource. This development will be the responsibility of the local areas. Overall, the quality of the visual resource is expected to remain at about the present level with minor changes.

Cultural. i. Terrestrial: With increased residential and industrial development, the coastal lands will be more intensively surveyed for archaelogical sites. As a result, more resources will be identified and archaeological data will increase. Although some mitigation will be undertaken in most cases, it

is likely some damage and looting will occur. There will be continued deterioration with age of some historic landmarks, but the current interest in protection and preservation will positively affect an even greater number of these sites than at present. Gathering by ethnic groups will continue to be a problem, because of excessive stress being placed on the intertidal areas

by over-harvesting. Coastal Native Americans will find subsistence and ceremonial gathering increasingly difficult as the supply of traditional foodstuffs decreases. Access to traditional gathering places will be variable.

ii. Offshore: Aboriginal artifacts, sites and historic shipwrecks will be subject to continued artifact hunting by sports divers. Divers have, however, been one of the best sources for discovering sites, and should continue to be so in the future. Some submerged cultural resources will be destroyed or damaged by natural foreces as they continue to lie on the bottom. However, those historical and prehistorical resources protected by sediments or in deep cool waters will continue to be preserved for a great many years.

Ports and Harbors. Further oil and gas activities in the Santa Maria Basin could lead to a need to use Port San Luis for a crew and supply boat base. Increased tanker activity (foreign and Alaskan crude) would increase the potential for conflicts at the Port of San Francisco. Further expansion of existing harbors is not anticipated at this time.

Marine Traffic. Commercial vessels using the Traffic Separation Scheme through the Santa Barbara Channel would increase from about 19 to 38 percent between 1980 and 2000. A similar increase could be anticipated for the San Francisco area. There could be an increase in foreign and Alaskan tankers carrying crude oil to the San Francisco and Los Angeles area refineries.

Refineries. Without the proposal, there would probably be an increase in the number of tankers (Alaskan and foreign) to the Los Angeles/Long Beach Harbor and the San Francisco Bay. These tankers would probably be needed to meet the demand for future oil requirements. At the time of this writing, California refineries are receiving about 670,000 b/d of Alaskan crude and about 165,000 b/d of foreign crude. Industry refineries (e.g., Union Oil Co., Shell Oil Co.) are just beginning to make expensive (about \$10 to \$800 million) modifications to their west coast refinering systems in order to eliminate imports and Alaskan crude oil shipments. These modifications are being made in anticipation of heavy, high sulfur crude from the California OCS.

Offshore Structures. The Federal leasing, exploration and development statistics covering all past Federal lease sales is presented in Table IV.C.3-1. The exploration and development estimates expected to result from leased tracts in the Santa Maria Basin (Sale No. 53 and RS-2) and State Waters (Point Arguello to Point Conception) are given in Table II.A.1.b-2. The existing hydrocarbon platforms in the State Waters of the Santa Barbara Channel are presented in Table III.C.6-3 (BLM, 1981). Activities associated with increased exploration and development on the OCS include: additional use of drilling vessels, platforms, support vessels, helicopters and geophysical survey vessels.

Military. The overall impacts expected as a result of the proposal would be reduced from high (significant modifications to military operations required) to none. The substantial overlap between the proposed sale and military

operating areas would be eliminated (space-use conflicts) along with the Proposals anticipated vessel traffic and structure placements.

As a result of anticipated future OCS and state tideland lease sales in Central California, future impacts to military operations are expected to be high, as the military uses approximately 55% of the OCS for various military operations, many of which require "exclusive-use" or joint-use with extensive coordination with other OCS users. Leases issued as a result of past OCS lease sales in California have had the leases stipulated with the Standard Military Stipulations. This is believed to adequately mitigate any impact to military operations. These lease stipulations would be a future option as well.

The impacts to miltary operations from OCS oil and gas activities would result from increased vessel traffic and the placement of permanent and semi-permanent offshore structures, as well as potential oil spills. The increased vessel traffic would necessitate extensive patrolling, surveillance, and clearance of an area prior to dangerous or classified military operations, causing additional time delays for the military operations. The placement of OCS structures would further limit the areas available to many military activities which require exclusive-use of the OCS, possibly forcing the elimination or significant modification of these activities. Additionally, potential oil spills in the area of OCS oil activities (including tankering) would temporarily increase vessel traffic in the vicinity of an oil spill due to cleanup efforts, thereby limiting military activities in that area until the cleanup operations are completed.

I. Environmental Impacts of Total Development

The Conditional Mean Resource Estimate is an estimate of the total undiscovered recoverable oil and gas given that hydrocarbons are present within the proposed sale area (for a detailed discription refer to Appendix I). The Conditional Mean estimate of oil and gas to be recovered from this area is 970 million barrels of oil and 950 billion cubic feet of gas. The Conditional Mean Resource Estimate and associated exploration, development, and production (See Section II.A.1.b,c, and d and Table IV.I-2) provide the basis for the analysis of a "high case." In the unlikely event that all the Conditional Mean resources are leased and developed as a result of Proposed Lease Sale No. 73 the following impacts are expected.

TABLE IV. I-1
TOTAL ESTIMATED OFFSHORE INFRASTRUCTURE
SOUTHERN SANTA MARIA BASIN
(CONDITIONAL MEAN)

Exploration wells	80
Delineation wells	40
Development wells	800
Platform	30
Pipelines	253
Subsea Completions	2

TABLE IV. I-2
OIL SPILL OCCURRENCES EXPECTED FROM
PROPOSED SALE NO. 73, EXISTING FEDERAL
LEASES AND IMPORTED OIL TRANSPORTATION
SOURCES WITHIN THE STUDY AREA
(CONDITIONAL MEAN)

Expected Number of Spills (and probabilities) by Spill Volume (bbls)

≥ 1,000 (probability)	3.00 (95%)
1-10,000 (probability)	1.67 (81%)
≥ 10,000 (probability)	1.32 (73%)

1. Physical Environment

a. Impact on Water Quality

i. Discussion: The level of impacts to water quality were discussed in Section IV.E.1 for the most probable case of development. The volumes of effluents predicted for the most probable case (Table IV.A.8. a-1) and the levels of impact will also increase.

Approximately 970,000 cubic yards of sediment will be moved during pipeline burial in the estimated high case. Impacts to water quality will be from temporary localized turbidity and are expected to be very low as will the impacts from any slight mobilization of trace metals or hydrocarbons in the disturbed sediments. Approximately five times the amount of drill cuttings and drilling muds are expected to be discharaged in the high case as in the most probable case. The volume of materials discharged from the expected 30 platforms will increase the level of impact to water quality from moderate (within 300 meters of discharge) and low (within 1000 m of discharge) to high (within 300 meters of discharge for the duration of the discharge) and moderate to low (within 1000 m of discharge during discharge periods). The level of impact to water quality outside 1000 m radius of the discharge point might also increase from very low to low for some additional unknown distance. These levels of impact are only approximate and depend on the oceanographic conditions at the time of muds and cuttings discharge. Should the 30 platforms be grouped on adjacent lease tracts, the level of impact to water quality would be greater over a wider area (moderate level over greater distance) than described above. This grouping of platforms is not expected.

An average of 200,000 barrels (8.4 million gallons) of formation water will be discharged each day in the sale area in the high development case. This estimated discharge compares in volume to the municipal sewage discharge from a city somewhat smaller than Oxnard, California (14 million gallons of municipal wastes per day). This volume of formation water is expected to result in low to very low levels of impact to water quality around the platforms. The areal extent of this impact in the sale area will depend upon oceanographic conditions promoting mixing and dilution of discharged water and the placement of the 30 expected platforms. It is expected that 94 square kilometers will experience low to very low levels of impact to water quality from formation water discharge. On a sale area wide basis, this impact level will be minimal.

Three spills larger than 1000 barrels volume are expected in the proposed sale area under the high case development. Impacts to water quality from the spills are expected to be moderate (increase in hydrocarbons 2-3 orders of magnitude above ambient levels). There is about a 14 percent probability of an oil spill hitting the Morro Bay area. Should this occur and spilled oil enter the estuary there, the level of impact to water quality would be very high in the shallow depths in the bay and estuary. This is not expected because protective booming would be used to protect the bay and estuary.

ii. Conclusions: Water quality in the immediate vicinity of platforms and pipeline burials will be degraded by routine discharges, emplacement activities, and accidental oil spills. The level of expected impacts to water quality in the high case development will range from moderate to very low (see definitions).

iii. Cumulative Impacts: At this time, there are no major sources of discharges in the proposed sale area and no plans for discharges which would add significantly to expected oil and gas discharges. The exception to this will be the proposed future sale of oil and gas leases in the tidelands of the State of California. Data on the expected development and discharges associated with that development are lacking and, thus, no conclusions as to cumulative Federal and State OCS operations are possible.

b. Impact on Ocean Dumping

i. Discussion: A detailed discription of the impacting agents to ocean dumping in Central California are described in Section IV.E.1.b. Bottom disturbing activities are the main impact producing agents to dump sites. There is a potential that 30 platforms, 800 wells, and 253 miles of pipeline could occur as a result of the sale. As the positions of the dump sites are known, the probability of one or more of these disturbances contacting a dump site would be low.

If the low-level radioactive waste dump site, located 56 miles off Point Arguello, is contacted a very high impact (see Appendix A for a listing of the levels of impact to ocean dumping and their definitions) is assumed, unless a prior bottom survey is conducted in the area.

OCS Order No. 2 requires a hazards report and other surveys as necessary for safe exploration and development activities on the OCS. A bottom survey of the area in which the dump sites are located should be run prior to the actual exploration or development activities. This survey would be performed to enable the operator to ascertain that none of the waste material will be disturbed by the development of the area. This will reduce the potential very high impact to very low.

ii. Conclusions: The impacts to dump sites are expected to be very low. However, if bottom disturbing activities occur without a prior survey in the low-level radioactive waste site area, a very high impact could occur from the disturbance.

iii. Cumulative Impacts: Impacts to ocean dumping in the region will occur from other projects and existing leases. The expansion at Vandenberg Air Force Base will have a need for an offshore dredge spoil site. The State Tidelands would not impact any sites since designated sites are not located in the planning area between Point Arguello and Point Conception. The existing leases in southern Santa Maria Basin are expected to have a very low impact to the dump sites in the area. The proposal does not significantly add to the impacts from these sources unless the low level radioactive waste site off Point Arguello is contacted.

c. Impact on Air Quality

i. Discussion: Impacts on air quality were estimated using a handbook prepared by Form and Substance, Inc., 1983b. For a discussion of specific air quality models and technical assumptions used, refer to Section IV.E.1.c.

Inert Pollutants. Annual emissions of air pollutants for the entire proposed sale area would reach a maximum in the peak production year, 1993. Air emissions would occur over a 30-year period, but total emissions would generally decline after the year 1993.

During the development phase, maximum annual average onshore concentrations of NO_x, SO_2, and TSP would generally be below the DOI Significance Levels for those pollutants. However, if two platforms were to be installed on adjacent tracts within the same year, the DOI Significance Level for NO_x could be exceeded. Under the DOI air quality regulations, best available control technology (BACT) would be required on equipment emitting significant amounts of nitrogen oxides. Maximum annual average onshore NO_x concentrat.ons would be well below the Federal ambient air quality standards (AAQS).

Maximum short-term average (24 hours or less) concentrations of SO_2, CO, and TSP during the development phase would be within the DOI Significance Levels. Maximum 1-hour average NO_2 concentrations would be 50 percent of the State AAQS. These concentrations would occur during platform installation.

During the peak production year (1993), the maximum annual average onshore concentration of NO_2 was projected to exceed the DOI Significance Level. Thus, BACT would likely be required on nitrogen oxides sources. Maximum annual average onshore concentrations of SO_2 and TSP would be well below the DOI Significance Levels. Maximum short-term average concentrations of NO_2, CO, and TSP would be lower than during the development phase. Maximum short-term average concentrations of SO_2 would be slightly higher than during the development phase, but would still be well below the DOI Significance Levels.

Onshore gas processing facilities would be a significant source of air pollutants, primarily NO_x. Air quality impacts would be unknown as they would depend on plant location and emission controls required. Emissions would be regulated by the local air pollution control agency.

Ozone. Trajectory models to compute ozone levels were run with trajectory endpoints at Nipomo and Santa Ynez. In both cases, the trajectories passed over 3 platforms with a combined oil production of 54,000 BOD. All 3 platforms were placed at one location to maximize calculated impacts. The Nipomo trajectory resulted in a maximum 1-hour average ozone increase of 4 parts per hundred million (pphm). The maximum baseline concentration (without OCS platform emissions) was 12 pphm. Since the Federal AAQS for ozone is 12 pphm, any increase above the baseline concentration would result in a violation of the Federal standard. The Santa Ynez trajectory resulted in a maximum 1-hour average ozone increase of 1 pphm. The maximum baseline concentration was 10 pphm. Since the State AAQS for ozone is 10 pphm, the increase in ozone would cause a violation of the State standard, but not of the Federal standard.

Since the results of ozone modeling indicate a possibility that emissions from proposed sale activities could cause significant increases in ozone concentrations, OCS operators would most likely be required to apply BACT to pollution sources. It is generally recognized that ozone formation is due to significant emissions of reactive hydrocarbons. Thus, BACT would be needed to significantly reduce hydrocarbon emissions.

If the three spills occur within a short period of time and all three contact the mainland, a very high impact will occur to recreation in the sale area. If one or more spills contact either Morro Bay or Pismo Beach area, a very high impact will occur locally and a high impact to the sale area.

If a spill contacts San Miguel Island, a low impact is expected for recreation in the sale area. If a large spill occurs and does not contact the shore, a moderate impact will result to recreation in the sale area.

Pipelines. Two pipelines are expected as a result of the proposal. These will have a very low impact on recreation as the closure of a stretch of beach would be of short duration.

Onshore Faciltiies. Onshore facilities are anticipated to have a low impact on recreation as they are assumed existing, or to be constructed with similar facilities.

Offshore Structures. A low impact to recreation is anticipated from the potential 30 platforms. This impact would be in the form of removing a small area from the use of recreational boaters and sportfishermen.

Vessel Traffic. The impact to recreation from vessel traffic is anticipated to be very low in the proposed sale area.

Noise. The impact of noise on recreation is anticipated to be very low for most of the life of the field. However, a moderate impact can be expected locally during periods of construction.

Air Quality. Air quality is expected not to change significantly.

ii. Conclusions: The complete development is anticipated to have a moderate impact to recreation over the sale area, with very high impacts to any areas that are actually contacted by an oil spill. The exact amount of economic impact to recreation will vary for each possible contact point and time of year of contact.

iii. Cumulative Impacts: Impacts to recreation occur both offshore and onshore from other projects and existing leases. The expansion at Vandenberg Air Force Base will cause a slight increase in vessel traffic in the sale area, as will the Point Conception LNG facility. Both of these activities have a very low impact to recreation. The State Tideland development will cause a moderate impact to recreation due to the offshore platforms, pipelines, onshore facilities, vessel traffic, noise, and oil spills in the area between Point Conception and Point Arguello.

The existing leases have a moderate impact in the Proposed Sale Area due to the increased number of offshore platforms, pipelines, onshore facilities, the amount of vessel traffic, the noise in the area and the potential oil spills. The proposal does not significantly add to the impacts from these sources. The impacts are anticipated to remain moderate to the recreation industry in the region, unless one of the expected oil spills contacts the shoreline.

h. Impact on Tourism

i. Discussion: Impacting agents to tourism in Central California are described in Section IV.E.3.h. Oil spills, offshore structures, onshore facilities, pipelines, noise, and air quality are the main impacting agents to tourism. (The levels of impact and their definitions are given in Appendix A.)

Oil Spills. Three large spills are expected to occur in the sale area as a result of complete development. There is a small probability that one or more spills will contact the coast within 30 days (see Section IV.A.4).

If the three spills occur within a short period of time and all three contact the mainland, a very high impact will occur to tourism in the sale area. If one or more spills contact either the Morro Bay or the Pismo Beach areas, a very high impact will occur locally and a high impact to the sale area.

If a spill contacts San Miguel Island, a low impact is expected to tourism in the sale area. If a large spill occurs and does not contact the shore a low impact will result to tourism in the sale area.

Offshore Structures. A moderate impact to tourism could occur if the potential 30 platforms are grouped directly offshore. If the platforms are relatively scattered throughout the sale area, a low impact to tourism is expected from the proposal.

Onshore Facilities. Onshore facilities are anticipated to have a very low impact on tourism as they are assumed existing, or to be constructed with similar facilities.

Pipelines. The two pipelines expected from the proposal will have a very low impact on tourism due to the low tourism in the areas of expected landfall.

Noise. Noise is anticipated to have a very low impact on tourism for the life of the field. However, a low impact can be expected locally during periods of construction.

Air Quality. Air quality is not expected to change significantly.

ii. Conclusions: The complete development is anticipated to have a moderate impact to tourism with very high impacts to any areas that are actually contacted by an oil spill. The exact amount of economic impact to recreation will vary for each possible contact point and time of year of contact.

iii. Cumulative Impacts: Impacts to tourism can occur due to other projects and existing leases in the area. The projects with the highest impact to tourism in the area are the Vandenberg Air Force Base expansion and the State Tidelands development. No tourism occurs at the beaches contained in Vandenberg Air Force Base due to the security of the installation. The State Tidelands development is planned for a secluded stretch of coast south of Point Arguello which is partly off Vandenberg and partly off private property. Tourism in this area is in the form of campers at Jalama Beach Park. A moderate impact is expected locally due to State Tidelands development.

Existing leases from Sale No. 53 would have similar impact on tourism as the State Tidelands development has on Jalama Beach Park. A similar impact would also occur at Surf and Point Sal. These areas of the coast are not large tourist centers, so although a moderate impact could occur locally, the remainder of the proposed sale area would have a very low impact on tourism.

The impacts from the proposal would be significant in that they would raise these impacts to moderate for the tourist industry.

i. Impact on Visual Resources

i. Discussion: Impacts to visual resources in Central California are described in Section IV.E.3.i. Offshore structures, oil spills, onshore facilities and pipelines are the main impacting agents to visual resources. (The levels of impact and their definitions are given in Appendix A).

Offshore Structures. Potentially 30 platforms would be placed in the sale area as a result of this proposal. The impact from the platforms depends upon their positioning. A very high impact to visual raesources could occur if all the platforms are grouped directly off the Morro Bay or Pismo Beach area. If the platforms are relatively scattered throughout the sale area, a moderate impact is expected for the entire sale area with localized high impacts to areas such as Pismo Beach.

Oil Spills. Three large spills are expected to occur in the sale area as a result of complete development. If a spill does occur and contact the shoreline, a temporary degradation in visual quality will occur. This will be a very high impact to the local area. The scenic quality of the sale area is varied and impact levels will tend to vary depending upon which area a spill contacts, and which time of year the spill occurs.

Onshore Facilities. Onshore facilities are anticipated to have a very low impact on visual resources as they are assumed existing or to be constructed with similar facilities.

Pipelines. The two pipelines are anticipated to have a very low impact at their landfalls, and a low impact along their onshore right-of-ways.

ii. Conclusions: The proposed development is anticipated to have a moderate impact to visual resources over the proposed sale area with localized high impacts. The exact amount of degradation will depend upon the impacting agent and the nature of the shoreline that is impacted.

iii. Cumulative Impacts: : Impacts to visual resources occur both onshore and offshore from other projects and existing leases. The other projects include the expansion of Vandenberg Air Force Base which will entail the construction of launch sites for the Space Shuttle and the expansion of the boat dock at the old boathouse at Point Arguello. This will be a low impact to the visual resources of the area.

State Tidelands development will cause a degradation of visual resources with the introduction of platforms into the State waters between Point

Conception and Point Arguello. This is anticipated to be a low impact to the visual resources in the area. Existing leases will cause a low impact to the visual quality due to the placement of platforms in the Sale No. 53 area at the southern end of the Santa Maria Basin.

The proposal significantly adds to the impacts from these sources in that the proposal increases the anticipated impacts from low to moderate.

j. Impact on Cultural Resources

i. Discussion: Impacts to cultural resourses in Central California are described in Section IV.E.3.j. Bottom disturbing activities, oil spills, onshore facilities,and visual intrusion of offshore structures are the main impacting agents to cultural resources. (The levels of impact and their definitions are given in Appendix A.)

Bottom Disturbing Activities. The potential 30 platforms, 800 wells, and 253 miles of pipeline are anticipated to have a low impact to the cultural resources of the sale area, as most of the shipwrecks in the area occurred close to land. A moderate impact is anticipated from the pipelines where they come to shore.

Oil Spills. Three large spills are expected to occur in the sale area as a result of complete development. Onshore cultural sites may be damaged during clean up operations, and intertidal gathering areas may be fouled and become unusable as gathering areas, if an oil spill occurs and contacts the shore. This would potentially be a very high impact at the local level and a moderate impact for the sale area.

Onshore Facilities. A very low impact is expected to the cultural resources in the area as most facilities required are already existing, or will be constructed with similar facilities. Since State and local jurisdictions onshore have primmary authority over onshore development, it is assumed that their requirements for cultural resource protection will significantly reduce the likelihood of sites being disturbed or destroyed.

Offshore Structures. A low impact on cultural resources in the sale area is anticipated from the intrusion of the potential 30 platforms into the viewshed of the cultural resources in the area.

If all the platforms are placed off Point Conception, a high impact could occur due to the Native American spiritual concerns. However, due to the expected distribution of platforms at Point Conception, the expected impacts are moderate.

ii. Conclusions: The proposed development is anticipated to have a moderate impact to the cultural resources over the proposed sale area with localized potential high impacts from any oil spills that contact the shoreline.

iii. Cumulative Impacts: Impacts to cultural resources over the region occur both offshore and onshore from other projects and existing leases. The other projects include expansion of Vandenberg Air Force Base and the State Tidelands development. The Vandenberg expansion requires dredging at the old boathouse at Point t. Arguello, dumping of the

dredge spoil offshore, and large onshore construction for roads, launch pads, and storage areas. All of these activities increase the potential impact to cultural resources. The State Tidelands development will have the same impacting agents as affect the OCS development, thus a low level of impact to cultural resources would be expected with development in State waters, except directly off Point Conception where a moderate impact would occur due to spiritual concerns of the Native Americans. The existing leases will have a similar expected level of impact in the region as the State Development.

The proposal significantly adds to the impacts from these sources in that the proposal increases the anticipated impacts from low to moderate with localized high impact occurring from potential oil spills.

k. Impact on Ports and Harbors

i. Discussion: The impacting agents that are associated with the proposal that may affect ports and harbors are: 1) additional vessel traffic (crew and supply boats, tankers); and 2) oil spills. The potential impacts that could occur as a result of these impacting agents are discussed in Section IV.E.3.k. An analysis of the impacts based on the high case follows.

Additional support vessel traffic that is expected to occur as a result of the development of the high case resources is as follows: Crew boats will be used to transport personnel to and from wellsites or platforms from Port San Luis, Gaviota, and/or possibly any of several existing bases in the Santa Barbara Channel. In the southern Santa Maria Basin, two trips per week per wellsite or platform are predicted to be made over the life of the proposal. Supplies taken to the wellsites or platforms could originate from Gaviota, Port Hueneme, and/or the San Francisco Bay area. Two trips per week (per wellsite or platform) are expected to be made by a supply boat during the exploratory, development, and production phases.

Offshore infrastructure in the southern Santa Maria Basin that is expected to result from development of the high case resources includes 80 exploratory wells, 40 delineation wells, 30 platforms, and 800 development wells, and 2 subsea completion systems. The assumed existing marine terminal offshore Gaviota would require expansion for the high case scenario. The assumed existing supply boat base at Gaviota would require expansion.

A total of 113 round trips per year from Gaviota to San Francisco is expected to be made in the peak year of production (1993) by a 27,000 DWT tanker in the high case scenario. A total of 23 round trips per year from Gaviota to the Gulf of Mexico (Galveston) is expected to be made in the peak year of production (1993) by three 45,000 DWT tankers in Alternative I (high case) (i.e., 69 total round trips). The expected impacts follow: Port San Luis - high (i.e., additional docks, berths, and facilities would be required); Port Hueneme, Gaviota, Port of San Francisco - moderate (i.e., some new facilities would be required, but major expansion or renovation would not be necessary).

The probability that a large oil spill will occur and contact a port or harbor in Central California is small (13 percent probability of occurrence and

contact with Port San Luis within 3 to 30 days; less than 6 percent probability of occurrence and contact with all other ports or harbors in Central and Southern California). Therefore, no impacts to ports/harbors as a result of oil spills are expected.

ii. Conclusions: High impacts to Port San Luis are expected primarily due to competition for vessel berth-space and support facilities. This competition would lead to the need for additional docks, berths, and facilities. Moderate impacts are expected at Gaviota, Port Hueneme and the Port of San Francisco (i.e., ome new facilities would be required, but major expansion or renovation would not be necessary).

iii. Cumulative Impacts: Cumulative impacts to ports and harbors as a result of development of the high case scenario, other projects (Section IV.D.), oil spills from existing leases and import tankering, and future increases in space and use demands will create additional conflicts at the ports and harbors. Since exploration, development, and production activity is a significant impact producing agent to ports and harbors, the proposal (high case) provides a substantial contribution to cumulative impacts to this resource category. The selection and development of Alternative I

(high case) will lead to additional tankering and support vessel activity, and an associated number of space use conflicts.

The contribution of the proposal (high case) to the cumulative probability of oil spills occurring and contacting a port or harbor is small, as discussed in the beginning of this section. The greatest contribution to the cumulative number of oil spills is from existing Federal leases and import (Alaskan and foreign) tankering. The probability that a large oil spill from existing Federal leases and import tankering will occur and contact the opening of San Francisco Bay is 36 percent within 3 days, and 44 percent within 10 and 30 days. The addition of proposal-related spills does not change these numbers. The numbers for Moss Landing are 4 percent within 3 days, 13 percent within 10 days, and 16 percent within 30 days. No spills from existing leases and import tankering are expected to occur and contact Port San Luis.

1. Impact on Marine Traffic

i. Discussion: The impacting agents that are associated with the proposal that may affect marine traffic are: 1) additional vessel traffic (i.e., tankers, crew and supply boats, geophysical survey vessels); and 2) offshore structures (exploratory rigs, platforms, and subsea completion systems). The potential impacts that could occur as a result of these impacting agents are discussed in Section IV.E.3.1. An analysis of the impacts based on the High Case is as follows.

A total of 113 round trips per year from Gaviota to San Francisco is expected to be made in the peak year of production (1993) by a 27,000 DWT tanker in Alternative I (High Case). This is based on an estimated peak oil flow rate of 61,986 bbl/day. The total distance traveled in this peak year by these tankers would be 66,896. A total of 23 round trips per year from Gaviota to the Gulf of Mexico (Galveston) is expected to be made in the peak year of production (1993) by three 45,000 DWT tankers in Alternative I (High Case) (i.e., 69 total round trips). This is based on an estimated peak oil flow

rate of 61,986 bbl/day. The total distance traveled in the peak year by these tankers would be 607,200 miles.

Assuming an average of 70 tanker round trips per year, emanating from the western Santa Barbara Channel over the Proposed Sale No. 73 26-year production period (high case), the statistically expected number of tanker casualties would be 0.1. A total of 0.3 severe casualties are expected. The probability of casualties would be highest in the peak year of production (1993) when 182 tanker round trips are predicted. The total number of casualties in the peak year would be 0.01; for severe casualties, 0.003.

Additional support vessel traffic, expected to occur as a result of the implementation of Alternative I (high case), is as follows: Two crew boat trips per week, per wellsite, are predicted to be made during exploratory phases of the proposal. A similar number of trips would be made (per platform) during development and production. Two supply boat trips per week (per wellsite or platform) are expected to be made during the exploratory, development, and production phases.

Offshore structures in the southern portion of the Santa Maria Basin that are anticipated to result from the implementation of Alternative I (high case) include 80 exploratory wells, 40 delineation wells, and 30 platforms with 800 development wells. An assumed existing marine terminal would lie just offshore Gaviota. This marine terminal would require expansion to handle the high case scenario. An assumed existing supply boat base would exist at Gaviota. In the high case, this supply base would be expanded, as would Port Hueneme. If additional space is required, it is expected to be in the San Francisco Bay Area. A crew boat base is anticipated to be constructed at Avila Bay (Port San Luis). Additionally, consideration has been given to the expansion of existing or assumed existing ports in the Santa Barbara Channel. Based on the presence of 30 platforms and a 26-year production period, the statistically expected number of platform-large vessel collisions would be 0.4. Therefore, there is a 60 percent likelihood that there would be no collisions between vessels and platforms over the lifetime of the proposal.

ii. Conclusions: Moderate impacts to marine traffic in the Central California and Santa Barbara Channel area would occur as a result of additional vessel traffic and offshore structures that are associated with Proposed Sale No. 73, Alternative I - high case. Moderate impacts to this resource category means that vessel conflicts occur frequently. Rerouting of shipping traffic would not be necessary.

iii. Cumulative Impacts: Cumulative impacts on marine vessel traffic as a result of the selection and implementation of Alternative I (high case), other projects (Section IV.D.), and future increases in marine traffic could result in more vessel-vessel and/or vessel-structures incidents. Moderate impacts (i.e., vessel conflicts occur frequently; rerouting of shipping traffic not necessary) are likely in Central California and the Santa Barbara Channel. Enactment of the Eleventh and Twelth Coast Guard Districts' recommended TSS modifications and additions (see Section III.C.12) would reduce the likelihood for these types of incidents.

The estimated number of vessel accidents during exploration, development, and production activities of the proposed sale should be small if U.S. Coast Guard

policy is followed. Presently, this policy does not permit surface hydrocarbon operations (drilling) within Precautionary Areas, safety fairways, or vessel traffic lanes. In the event hydrocarbon operations are permitted within the proposed vessel traffic lanes and precautionary area in the southern Santa Maria Basin, potential impacts on shipping could be: high economic losses to the shipping and oil industries, loss of lives, and increased probability of a large oil spill.

Since exploration, development, and production activity is a significant impact producing agent to marine traffic, the proposal provides a substantial contribution to cumulative impacts to this resource category.

m. Impact on Refineries

i. Discussion: The impacting agent that is associated with the proposal that may affect California refineries is sour (high sulfur) and heavy (low API) crude oil.

California refineries have the capacity and would process all of the Proposed Sale No. 73 crude oil (high case) that is shipped or piped to them (Yamasaki, 1983). No new refineries are proposed or expected. Unless Proposed Sale No. 73 crude oil is beyond the refineries' limiting factors, there should be no impact on the refineries. However, Proposed Sale No. 73 crude oil is expected to be relatively sour (high sulfur) and heavy (low API). Therefore, this quality of crude oil would represent a partial contribution to the need for expensive modifications to the refinery processes. The cost of these modifications is estimated to be from $10 million to $800 million per refinery (1982 dollars). On a local and worldwide basis, the quality of oil is also decreasing. Furthermore, the South Coast Air Quality Management District has proposed (in draft form) an air quality management plan which would require modifications to refineries by 1987. (See Sections III.A.9 and IV.E.1.c for further details.) Thus, in the future, refinery modifications will need to be made to handle lower quality crude oils.

The trend toward refinery modifications is evident in California (see Yamasaki, 1983 for details). Recently, Shell Oil Co. started the first phase of an $800 million program to modernize its U.S. West Coast refining system (Oil and Gas Journal, September 13, 1982). Union Oil Co. is also modifying their Los Angeles refinery.

Low impacts to California refineries (Los Angeles and San Francisco) are expected as a result of the high case. Low impacts are defined as follows: Proposed Sale No. 73 crude oil is expected to represent a partial contribution to the requirement for expensive modifications to the refinery process. See Appendix A for a definition of all impact levels for this resource.

ii. Conclusions: California refineries have the capacity and would process all Proposed Sale No. 73 crude oil (high case) that is shipped or piped to them. Therefore, there would be no need for new refineries to be constructed.

However, it is expected that most of the Proposed Sale No. 73 crude oil would be heavy and high in sulphur content. This quality of crude would contribute to the need for expensive modifications (i.e., retrofitting) to the refinery

process. The cost of these modifications is estimated to be from $10 million to $800 million per refinery (1982 dollars). This is considered to be a low impact to individual refineries. That is, Proposed Sale No. 73 crude oil is expected to represent a partial contribution to the requirement for expensive modifications to the refinery process.

iii. Cumulative Impacts: Cumulative impacts (high case) on refineries as a result of the selection of Alternative I, other projects (Section IV.D.), and future increases in oil production would result in moderate impacts to refineries. These impacts are defined as a major contribution by future crude oil production to the need for expensive modifications to refineries.

n. Impact on Offshore Structures

i. Discussion: The impacting agents that are associated with the proposal that may affect existing offshore structures are: 1) platform and pipeline installation activities, and 2) additional vessel traffic. The potential impacts that could occur as a result of these impacting agents are discussed in Section IV.E.3.n. An analysis of the impacts based on the high case is as follows.
Subsea pipelines which are associated with marine terminals near Morro Bay and Port San Luis could be impacted as described in Section IV.E.3.n. However, it is unlikely that these impacts would occur. Therefore, no impacts are expected to existing offshore structures in the Santa Maria Basin.

Structures in the Santa Barbara Channel include platforms, subsea completion systems, pipelines, an OS and T vessel, and exploratory rigs. Impacts to these existing oil and gas structures will occur in the Santa Barbara Channel as a result of additional vessel activity from the proposal (Alternative I - high case). A total of 113 round trips per year from Gaviota to San Francisco is expected to be made in the peak year of production (1993) by a 27,000 DWT tanker in the high case scenario. A total of 23 round trips per year from Gaviota to the Gulf of Mexico (Galveston) is expected to be made in the peak year of production (1993) by three 45,000 DWT tankers in Alternative I (high case) (i.e., 69 total round trips).

Additional support vessel traffic expected to occur as a result of the implementation of Alternative I (high case) is as follows: Two crew boat trips per week, per wellsite, are predicted to be made during exploratory phases of the proposal. A similar number of trips would be made (per platform) during development and production. Crew boats would originate from Port San Luis, Gaviota, and various other existing or assumed existing ports/harbors in the Santa Barbara Channel.

Two supply boat trips per week (per wellsite or platform) are expected to be made during the exploratory, development, and production phases. Supply boats would emanate from Gaviota, Port Hueneme, or possibly the San Francisco Bay area. Low impacts from this additional vessel activity are expected to occur to offshore structures within the Santa Barbara Channel.

ii. Conclusions: Impacts to existing offshore structures (platforms, pipelines, subsea completion systems, OSTs, etc.) will be confined to the Santa Barbara Channel since the only existing platforms are in this area. Impacts will be due to small vessels contacting the platforms. These

impacts are expected to be low (affected structures could be repaired, with little, if any, replacement; down-time would be only 1 or 2 days).

iii. Cumulative Impacts: Cumulative impacts to offshore structures as a result of the selection of Alternative I (high case), other projects (Section IV.D.), future oil and gas infrastructure, and increased vessel traffic, will add additional conflicts at the offshore structures. An unknown number of additional platforms, artificial islands, subsea completion systems, and vessel traffic may occur as a result of continued resource development in the State of California tidelands. The cumulative effect of the high case resources would result in a high probability of moderate impacts to offshore structures (i.e., affected structures could be repaired with some replacement; these activities would result in down-time of a few days to one week).

o. Impact on Military Uses

i. Discussion: The military operating areas, activities, and impacting agents are the same as discussed in Section IV.E.3.o. (most likely case). For the conditional mean resource level (high case), however, the placement of 30 permanent production platforms (compared to five for the most likely case) is predicted in the sale area over the production life of fields developed as a result of this sale. This is six times greater than the most likely, and would increase the impacts expected to military operations to very high (exclusive-use areas would have to be completely shifted, curtailed, or eliminated) (from high) from the structure placement and the accompanying level of vessel traffic. Impacts from oil spills would increase to low (from none) as three oil spills are predicted.

ii. Conclusions: The overall impacts expected to military operations will be very high (exclusive-use areas would have to be completely shifted, curtailed, or eliminated; extensive alteration or reductions to military operations would be required) as substantial overlap of military operating areas and the Proposed Sale No. 73 area exists (87%.)

iii. Cumulative Impacts: The cumulative impacts expected to military operations will remain very high (exclusive-use areas would have to be completely shifted, curtailed, or eliminated). The existing leases in the Santa Maria Basin have all been stipulated, adequately mitigating any impacts to military operations. Other activities (See Section IV.E.3.O.) are not expected to affect the impact level.

J. Unavoidable Adverse Impacts

Offshore operations would have low to very low unavoidable impacts on water quality. Drilling, construction activities, and pipelaying would cause an increase in turbidity in surrounding waters. Discharge of treated sewage from rigs and platforms would increase levels of suspended solids, nutrients, chlorine, and BOD in a small area. Chronic spills from platforms and the discharge of formation waters would cause increases in hydrocarbons and possibly trace metals in the surrounding waters. Spilled oil that is not recovered would release hydrocarbons and trace metals into the environment. If oil is entrapped in bottom on shoreline sediments, water quality degradation would continue for an extended time. Moderate impacts on water quality would be expected from the one predicted oil spill in the proposed lease sale area.

Offshore oil and gas development would cause slight increases in onshore concentrations of NO_x, SO_x, TSP, CO and O_3. The proposed project could adversely affect O_3 levels in the Santa Barbara County Nonattainment Area. These adverse effects could be largely controlled by applying best available control technology to some of the more significant OCS sources. However, in some areas appropriate emission offsets may be necessary to insure compliance with local air quality regulations. This could limit growth of certain onshore industrial activities. Refineries located in the San Francisco and Los Angeles areas may be moderately impacted as the processing of higher sulfur OCS oil may necessitate installation of additonal pollution control equipment or expensive modifications to the facilities.

Minor decreases in benthic organisms would occur in the vicinity of drilling and pipeline laying and burying operations. Toxic materials from the discharge of drilling fluids and cuttings may adversely affect some hardbottom communities in a limited area in the vicinity of platforms.

Fresh oil spills could cause moderate to high impacts to benthic organisms, fish, marine mammals and seabirds in the proposed sale area. The occurrence of one oil spill would be likely during the lifetime of the proposed project. This could result in localized, severe mortalities and functional impairment to some species, thereby altering the community structure for an unknown period of time. A large oil spill could cause moderate (2-7 percent mortality) impacts to the least tern population, and high (7-15 percent mortality) impacts to the brown pelican population.

The probability of an oil spill contacting the Sea Otter Range or a marine sanctuary would be low. However, if a large oil spill were to contact a Southern Sea Otter area, a high (15-30 percent mortality) impact could result and the species may become endangered. An oil spill contacting an estuary would cause locally very high impacts.

It is possible that the gray whale would change some migratory routes due to increased human disturbances from vessel traffic. Preferred niches could be abandoned. Impacts on the gray whale would be low to very low. Populations could be somewhat limited for the duration of the proposed project because of increased competition for space and resources. Unavoidable adverse impacts, ranging from low to high, would result from the effect of noise and disruption on sea otters, seals, sea lions, and toothed whales.

There would be unavoidable moderate impacts on public services and facilities such as water supply systems and wastewater treatment plants. Construction of onshore pipelines a well as land needed for OCS support systems may create minor land use conflicts.

Overall impacts to the commercial fishing industry would be low (less than a 10 percent economic loss to the industry). The commercial trawl fishery would experience moderate economic losses for about 3 years due to disruptions caused by pipelaying operations. Some unavoidable losses due to navigation hazards or loss of fishing gear from snagging on abandoned subsea wellheads and pipelines would likely occur. However, the impacts from damage to fishing gear would be minimized by the Wells and Pipeline Stipulation which has been adopted in recent Pacific OCS Sales. A large oil spill could cause a moderate impact to the commercial fishing industry (a 10 to 20 percent economic loss) if the spill contacts salmon populations at the mouths of rivers or affects a fishing port.

Sportfishing may be adversely affected as a result of oil spills that could close parts or sections of the coastline to fishing activities. An oil spill contacting the coastline would also have an unavoidable impacts on recreation as beach and boating activities would be temporarily disrupted. Visual quality of the environment would be degraded by platforms being visible from some sections of the coastline, and also may have a slightly negative effect on tourism. In case of an oil spill reaching the coastline, the associated publicity could cause a sharp decline in tourism in the affected area. The economic loss to sportfishing and tourism in an area contacted by an oil would be irretrievable. There would be a small possibility that marine archaeological artifacts may be damaged or destroyed by structure siting and anchoring, or by oil spills.

Unavoidable high impacts would occur to the port of Port San Luis due to the need for additional docks, berths, and related facilities. There would be a small, unavoidable increase in vessel traffic. Support vessels and tanker traffic could cause a low adverse impact on existing offshore structures in the Santa Barbara Channel because of a slight risk of collisions.

Some unavoidable potential conflicts would occur with certain military activities requiring exclusive use of the OCS.

K. Relationship Between Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity: The proposed OCS Sale No. 73 would result in the production of 291 million barrels of oil and 285 billion cubic feet of gas over a 20-year period, according to the most likely resource estimate. This would represent a short-term gain by providing for some energy requirements and helping reduce imports of foreign oil. However, the production and consumption of oil and gas would preclude their use at a future time and reduce long-term reserves. The estimated total undiscovered recoverable hydrocarbon resources for the Proposed Sale No. 73 area is 970 million barrels of oil and 950 billion cubic feet of gas. Thus about 30 percent of the total recoverable oil and gas reserves would be used up.

The development of the oil and gas resources could result in the discovery of additional reserves beyond those estimated, which could extend OCS oil and gas

production beyond the time period anticipted for this proposed project. This could magnify and prolong some of the anticipated short-term impacts on the environment.
Adverse impacts on water quality from drilling construction, discharges, and chronic oil spills would be low. Impacts from oil spills could be locally very high. No impacts form oil spills affecting water quality would be expected to last beyond the lifetime of the proposed project.

Impacts on air quality would be low after appropriate mitigating measures are taken. Some onshore air pollution sources may be affected by emission offsets. Short-term moderate impacts are likely to effect the refineries because of required equipment modifications, while long-term impacts would be unknown.

Minor decreases in plankton, benthic organisms, and fishes would result from drilling and construction activities. Impacts would be localized and short-term. Oil spills could result in localized mortalities of marine mammals, seabirds, or endangered and threatened species. In most cases, impacts would be short-term unless significant long-term changes in the food web occur. The probability of an oil spill affecting estuaries, wetlands, or marine sanctuaries would be very low. However, if an oil spill were to occur, impacts to sensitive species could be long-term.

This would result in short-term stresses on public facilities and services and land use. Some short-term benefits would be derived from a very slight (0.4 percent) increase in employment. No significant long-term socioeconomic impacts would be anticipated. There would be short-term, moderate impacts on water supply systems and wastewater treatment plants. Minor short-term land use conflicts would occur from pipeline construction and OCS support bases.

Commercial fisheries would likely experience some low short-term impacts due to disruption of activities during the exploration and development phase. Impacts on trawl fishing would be moderate. No long-term changes in productivity would be expected.

Short-term negative impacts would occur to sportfishing, recreation, visual resources, and tourism. Long-term impacts on cultural resources could occur from damage to marine archaeological sites.

There would be a high short-term impact on ports and harbors, due to the need for additional docking facilities. There also would be a small increase in marine traffic.

In summary, short-term gains would be expected in terms of increased domestic oil and gas production. However, long-term reserves would be more rapidly depleted, thus making less oil and gas available for future use. Some short-term adverse effects on the physical, biological, and socioeconomic environment would occur. The probability of any long-term ecological damage would be very small.

L. Irreversible and Irretrievable Commitment of Resources: Estimated total production associated with the Proposed Sale No. 73 would consist of 291 million barrels of oil and 285 billion cubic feet of gas. These resources, once developed and consumed, would be irretrievable.

Losses of benthic organisms, marine mammals, seabirds, and fishes during drilling and construction activities would generally be reversible as populations would return to normal levels after the impact-producing activities are discontinued. Oil spill damage would be largely reversible. However, large oil spills could do irreversible harm to threatened and endangered species, estuaries, wetlands, and marine sanctuaries by inflicting high mortalities or bringing about major changes in the food web. The probability of this occurring would be very low.

Use of specialized equipment or scarce labor skills would represent an irretrievable commitment of these resources as they would be unavailable for similar projects elsewhere. Changes in land use would usually not be considered irreversible. However, in some cases where natural features or processes are disrupted, a return to previous type of land use may not be possible. Ground water depletion could disrupt water supply capabilities or result in modifications to the landscape through subsidence, vegetation changes, or desication. The affected land or water resources could be irretrievable.

Losses to commercial fisheries, sportfishing, recreation, and tourism would be irretrievable for the duration of the proposed project, but not irreversible since no impacts would occur after project completion. Adverse impacts on visual quality would be mostly eliminated after project completion. Damage to cultural resources may be irretrievable since once an historical artifact were to be destroyed, it could never be reclaimed.

CONSULTATION AND COORDINATION

V.

CHAPTER V

V. CONSULTATION AND COORDINATION

Consultation and coordination was conducted with Federal, State, and local government agencies, environmental groups, industry, and individual citizens. This coordination was carried out pursuant to the National Environmental Policy Act (NEPA) implementation regulations which require a continuous and open process for determining the range of issues to be addressed and for identifying the significant issues related to the proposed action. This process not only identifies significant issues but also narrows the focus of the environmental impact statement.

A. Resource Inventory Central and Northern California. The collection and maintenance of a comprehensive inventory of resource data is an on-going process which encourages communiction with all interested agencies and groups. It not only provides the resource data for the analysis of the environmental impact statement, but also identifies significant public concerns.

A meeting was held with the Pacific Regional Technical Working Group (RTGW) committee of the National OCS Advisory Board on June 22, 1982. The agenda included an opportunity to identify and clarify issues related to potential oil and gas development off central-northern California.

The issues which were identified by MMS and the RTGW which relate to Central California were incorporated as appropriate into the Proposed Sale No. 73 EIS. MMS responses to issues raised by the RTWG are as follows:

1. Geotechnical forces. Relationship between the withdrawal of fluids from formations and seismic activity. (Does extraction trigger seismic activity?)

Response: The withdrawal of fluids from formations can cause reservoir compaction and result in subsidence rather than seismic activity. Most of the observed cases of subsidence (Wilmington and Inglewood Fields) are where oil and gas was withdrawn close to the surface. A repressurization program of water injection has stopped, and in some areas reversed the subsidence in the Wilmington Field. A pore-fluid pressure program is usually begun after the start of production and will continue throughout the life of the field.

2. Cumulative effects of discharges on water quality.

Response: The cumulative effect of discharges on water quality have been addressed in Section IV.E.1.a.

3. Paucity of data on water movement and circulation affects discussion of biological environment (food sources, etc.).

Response: The limits to the present knowledge of water movement and ocean circulation are briefly mentioned in Section III.A.4. We are aware of the link between ocean circulation at meso and macro scales and the advection of food, transport of larvae, etc. The same is true for the links among physical, chemical, and biological processes on micro (sub meso) scales such as upwelling.

The Organization of Persistent Upwelling Systems project will address the dynamics of such a system.

4. State (California) Water Quality Control Board is currently (June 1982) preparing an EIS on the Water Quality Plan.

Response: Presently (November 1982), the Water Quality Control Board is still working on modifications to the Ocean Plan. Upon the completion of the EIR a copy of the document will be reviewed and incorporated, as appropriate, into the EIS.

5. Assess clean-up capabilities of high pour point oil versus other methods. Can high pour point oil be handled by conventional equipment?

Response: Clean-up capabilities including high pour point oil have been discussed in Section IV.B.2.

6. Effects of "hostile" physical factors (storm surge, wind, wave, weather) on offshore oil and gas operations. What limitation does hostile environment place on operations? What additional risks to biological and human environment are present?

Response: The effects of "hostile" physical factors are discussed in the Effects of the Physical Environment on Oil and Gas Operations, Section IV.A.10. Description of oceanographic and meteorlogical parameters has also been referenced to previous EISs and the NOAA report (Williams, 1981).

7. Cumulative impacts on Central California should use State's resource estimates for potential State lease areas (Point Arguello to Point Conception) until exploration activity yields different estimates.

Response: The resource estimates for the potential State lease area have been included for analysis of the cumulative affect of oil and gas development for the proposed sale area. See Sections IV.C and D.

8. Disruption of "live bottoms" should be addressed in addition to disruption of spawning areas (for fish).

Response: Disruption of fish feeding and reproductive habitats for commercial and non-commercial species are addressed in Section IV.E.2.c.

9. Incorporate information on critical life stages into analysis of impacts on benthos and fish.

Response: Critical life stages and time of year that is critical have been considered in the analysis of benthic and fish populations in Sections IV.E.2.a, b, and c. For simplicity, the probabilities of an oil spill occurring and contacting benthic and fish populations on a yearly basis have been presented in Sections IV.E.2.a, b, and c. The probabilities of an oil spill occurring and contacting fish populations during critical seasons are also very low.

10. Effects of habitat disruption/destruction on non-commercial species of fish.

Response: See Response #8.

11. Effects of noise (in addition to seismic soundings) on commercial fish stocks. There have been discussions about this issue in other areas, especially with respect to cod in the Canadian Artic and North Sea.

Response: The effect of noise from geophysical vessel operations on fish is discussed in Section IV.E.2.c. The impact of noise from other activities is not discussed since, judging from the large number of fish congregated near platforms, this noise apparently does not significantly impact fish populations.

12. Potential fouling of commercial fishing gear by hydrocarbons (in addition to loss of equipment on debris, anchors, etc.).

Response: These impacts are discussed in Section IV.E.3.

13. Investigate problem of debris (cement) from trimming (blowing up excess cement) well caps to be flush with bottom. Trawlers affected. Check whether less cement can be used so "trimming" is not necessary (or involves less material).

Response: Wells are permanently abandoned to fill in the holes and to remove structures above the sea floor that may interfere with trawling. In order to complete a well safely, our regulations require that holes be cased to the surface. This procedure may result in some overflow of cement onto the sea floor. Since this cement generally forms a thin layer, it would rarely, if ever, pose a significant problem to trawling operations.

14. Impacts on harvestable fish and invertebrate stocks should include both acute toxic effects and the problem of tainting.

Response: The EIS addresses these issues.

15. Delineation of fishing activity by both area and season is useful - both in text and (especially) on visuals.

Response: We realize that precise delineation of fishing areas would be a useful tool, and we continue to strive to obtain this information whenever we can. However, there are several problems which make this task difficult: 1) fishermen do not like to reveal the location of their prime fishing spots; 2) data that is available is not in a form that can be readily used (e.g., log book records); and 3) prime fishing areas frequently change on a seasonal and yearly basis. The catch by Origin (fish block) data compiled by the California Department of Fish and Game is the best available data at this time. When exploration and development plans are prepared, the location of these activities will be known and site specific information on fishing activities can be reasonably obtained from local fishermen.

16. Provide current data on catch statistics and market value of commercial fish.

Response: The most recent data (1976-1977) available from the California Department of Fish and Game (CDFG) is used in the Draft EIS (see Section III.C.5). CDFG plans to have more current data available for the public soon. If this data is available as planned, it will be incorporated into the Final EIS.

17. Review organization of analyses on fish, commercial fisheries, sport fisheries. Analysis should focus on fish themselves and continue into fisheries. Both commercial and sportfishing should be addressed.

Response: The EIS follows this format.

18. Salmon should be discussed as both a commercial and sport fishery, as appropriate.

Response: Impacts on commercial and sportfishing for salmon are discussed in Sections IV.E.3.e and f.

19. Potential impacts on fishermen competing for limited mooring and berthing facilities.

Response: Competition for port space between fishermen and oil and gas industry is discussed in Section IV.E.3.c.

20. Volume of traffic entering and leaving San Francisco Bay. Formal establishment of traffic lanes in Central/Northern area (north, south and west from San Francisco) is forthcoming. Note that the use of the lanes is discretionary.

Response: The marine traffic entering and leaving San Francisco Bay has been discussed in Section IV.E.3.1.

B. Request for Resource Reports. In accordance with 30 CFR 255.22 Minerals Management Service (formerly Bureau of Land Management) requested other Federal, State, and local agencies to prepare reports describing, to the extent known, any other valuable resources contained within the general area and the potential effect of mineral operations upon the resources or upon the total environment or the use of the area. The request for Resource Reports were sent to the agencies and groups listed below in July 1980.

Responses received from these agencies and groups referred MMS to comments and related information received during the comment period and specifically at the public hearings for Lease Sales 53 and 68. Many of the comments submitted contained concerns which were similar to those for prior lease sales. (Minerals Management Service, Pacific OCS/Lease Sale No. 73 EIS files).

Federal Agencies

Department of Agriculture
Forest Service

Department of the Air Force
  Civil Engineering

Department of the Army
  Corps of Engineers

Department of Commerce
  National Oceanic and Atmospheric Administration
    Office of Ecology, and Environmental Conservation
    *Office of Coastal Zone Management
    Office of Fisheries

Department of Defense
  Installation and Housing

*Department of Energy
  *Economic Regulatory Administration
    Office of Petroleum Operations
  *Federal Energy Regulatory Commission
  *Leasing Policy Development

Department of the Interior
  *Fish and Wildlife Service
  Geological Survey
  Heritage Conservation and Recreation Service
  National Park Service

Department of the Navy

*Department of Transportation
  Coast Guard

*Environmental Protection Agency
  Office of Environmental Review

*National Aeronautics and Space Administration

State and Local Agencies

Governor of California
California Air Resources Board
California Coastal Commission
*California Department of Boating and Waterways
*California Department of Fish and Game
California Energy Commission
California Public Utilities Commission
*State of California Department of Parks and Recreation
*State of California Division of Mines and Geology
State Lands Commission

*Humboldt County, Board of Supervisors
Del Norte County, Board of Supervisors
*Los Angeles County, Department of Regional Planning
Marin County, Planning Director

Mendocino County, Board of Supervisors
Monterey County, Board of Supervisors
*San Diego County, Board of Supervisors
San Francisco, County and City, Office of the Mayor
San Luis Obispo County, Coastal Energy Impact Program
*San Mateo County
Santa Barbara County, Board of Supervisors
*Santa Barbara County, Department of Environmental Resources
*Santa Cruz County, Board of Supervisors
*Sonoma County, Board of Supervisors
*Ventura County, Board of Supervisors

Association of Bay Area Governments
Association of Monterey Bay Area Governments

*Trinidad

C. Call for Nominations and Comments. In order to assist the Secretary of Interior in implementing Section 102 of the Outer Continental Lands Act, as amended 43 USC 1331-1343 and pursuant to 30 CFR 256.25 nominations were requested for areas on the California Outer Continental Shelf for possible oil and gas leasing. The Secretary also requested comments on the possible environmental impacts and potential use conflicts in specific areas. The area under consideration for the Call extended from the U.S.-Mexico border northward to the California-Oregon border. The Call was published in the Federal Register on November 28, 1980 (45 FR 231).

The Call requested nominations of tracts for leasing of oil and gas in specific areas. A total of 2870 blocks were nominated by fifteen companies.

The Call also requested comments on tracts which should receive special concern and analysis. These concerns consisted of comments on geological hazards, air quality, cultural sites, and multiple uses of the proposed lesing area including recreation, commercial fisheries, biological and vessel traffic. Comments were received which addressed the conflicts which might arise from the leasing of specific tracts or areas. Many of the comments (1,543 postcards) were negative nominations of tracts or areas to eliminate or minimize the risk of damage to the human, marine, and coastal environment. Many comments reemphasize issues identified in Lease Sale No. 53 process. A complete list of comments is available for public review in the MMS - Pacific OCS/Lease Sale No. 73 EIS files.

D. Scoping Process

On December 30, 1982 pursuant to Section 1501.7 of the National Environmental Policy Act of 1969, a Notice of Intent (NOI) was released for Proposed Sale No. 73. The NOI announced that the EIS would focus on the potential impacts of leasing, exploration, and development in the southern portion of the Santa Maria Basin. Comments concerning the range on Proposed Sale No. 73 were due January 31, 1983. Federal, State and local agencies, and interested groups and individuals submitted 724 written comments (includes 669 postcards).

The comments and issues received as a result of the scoping process were summarized and evaluated. Those issues which were identified as significant

* Responses received

have been distributed to 54 public locations (ie. universities, Public Libraries, and County Planning Offices) throughout the Coastal Counties for public inspection.

Federal Agencies

U.S. Department of Commerce
  National Oceanographic and Atmospheric Administration
    National Marine Fisheries Service
      Office of Coastal Zone Management

U.S. Department of Defense
  Army Corps of Engineers
  Department of the Navy

U.S. Department of Energy
  Federal Energy Regulatory Commission
  Office of Leasing Policy Development
  Nuclear Regulatory Commission

U.S. Department of State

U.S. Department of the Interior
  Fish and Wildlife Service
  Geological Survey
  National Park Service

U.S. Department of Transportation
  Coast Guard
  Office of Pipeline Safety Operations
  Office of Safety Affairs

U.S. Environmental Protection Agency

Marine Mammal Commission

State Agencies

Air Resources Board
Clearing House
Coastal Commission
Department of Fish and Game
Division of Mines and Geology
Lands Commission
Governor's Office of Planning and Research
Parks and Recreation
Water Resources Control Board

City Governments

Municipal Organizations

County Agencies

are discussed within the EIS. Those issues which were eliminated from detail study were not considered significant or have been adequately covered by prior environmental review (See Section I.F). A complete listing of the issues is available for public review in the MMS Pacific OCS/Lease Sale No. 73 EIS files.

Responses to scoping were received from the agencies and groups listed below:

Environmental Protection Agency
State of California
  Sectretary of Envrionmental Affairs
State of Oregon
  Department of Land and Conservation

Del Norte County
Marin County, Planning Department
Mendocino County, Administrative Office - Planning Analysis Division
Monterey County, Board of Supervisors
San Mateo County, Department of Environmental Management
Santa Barbara County
Santa Cruz County, Board of Supervisors

City of Carmel by the Sea
City of Grover City
City of Pismo Beach
City and County of San Francisco

Air Pollution Control District
American Lung Association -Monterey, Santa Cruz, San Luis Obispo Counties
Association of Monterey Bay Area Governments
California Gillnetters Association
California Native Plant Society - San Luis Obispo Chapter
Envrionmental Center of San Luis Obispo County
Federation of Fly Fishers
Friend of the Earth
Friends of the Sea Otters
Green Peace Pacific Southwest
League of Women Voters - Monterey Peninsula
League of Women Voters - San Luis Obispo
Marin Conservation League
Morro Coast Aububon Society Inc.
San Luis Obispo County and Cities Area Planning And Coordination Council
Sierra Club - Loma Prieta Chapter
Sierra Club - Santa Cruz Regional Group
Sierra Club - San Francisco Bay Chapter
Sierra Club - Ventana Chapter

E. Distribution of the Draft EIS for Review

Over 1,000 copies will be automatically distributed to various agencies and groups under the categories listed below for their review and comment. Interested organizations and individuals who did not receive a copy during the first mailing will be sent one upon request. Due to public concern copies of the EIS

Special Interest/Environmental Agencies

Industry

Businesses

Public Media

F. Endangered Species Consultation

Pursuant to Section 7 of the Endangered Species Act, consultation with appropriate Federal agencies is required when there is reason to believe that a species that is on the list as endangered or threatened (or is proposed to be listed as such) may be affected by a proposed action.

In accordance with Section 7(c) of the Endangered Species Act of 1973, as amended, a request to initiate formal consultation on Proposed Sale No. 73 was sent to the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service.

[illegible] A complete listing of the [illegible] is available for public review at the [illegible] Pacific [illegible] file.

Responses to scoping were received from the agencies and groups listed below:

Environmental Protection Agency
State of California
[illegible]

Del Norte County
[illegible]
[illegible]
[illegible]
[illegible] County
Santa Cruz County, Board of Supervisors

City of Carmel by the Sea
City of Grover City
City of Pismo Beach
City and County of San Francisco

Air Pollution Control Districts
American Lung Association - Monterey, Santa Cruz, San Luis Obispo Counties
Association of Monterey Bay Area Governments
California [illegible] Association
California Native Plant Society - San Luis Obispo Chapter
Environmental Center of San Luis Obispo County
Federation of Fly Fishers
Friends of the Earth
Friends of the Sea Otter
Greenpeace Pacific Southwest
League of Women Voters - Monterey Peninsula
League of Women Voters - San Luis Obispo
Marin Conservation League
North Coast Audubon Society Inc.
San Luis Obispo County and Cities Area Planning and Coordination Council
Sierra Club - Loma Prieta Chapter
Sierra Club - Santa Cruz Regional Group
Sierra Club - San Francisco Bay Chapter
Sierra Club - Ventana Chapter

D. Distribution of the Draft EIS for Review

Over 1,000 copies will be automatically distributed to various agencies and groups under the categories listed below for their review and comment. Interested organizations and individuals who did not receive a copy during the first mailing will be sent one upon request. [illegible] public comment copies of the EIS

REFERENCES

VI.

CHAPTER VI

VI. REFERENCES

Addy, J.M. et al. 1978. Biological Monitoring of Sediments in Elkfish Oilfield. In: Proc. Conf. Assessment of Ecological Impacts of Oil Spills. A.I.B.S. pp. 515-539.

Aerocomp, Inc. 1982. Summary and Analysis of Northern California Buoy Data. Prepared for Bureau of Land Management, Pacific OCS Office, Los Angeles, CA (Contract No. AA851-CTO-62), July 1982.

AeroVironment, Inc. 1981. Southern California Offshore Air Quality Model Validation Study. Prepared for Bureau of Land Management. Pacific OCS Office, Los Angeles, CA (Contract No. AA851-CTO-56) November 1981, 2 Vol.

Ainley, D.G. et al. 1981. Petroleum Ingestion Reduces Reproduction in Cassin's Auklets. Mar. Pollut. bull. 12:314-317.

Albers, P.H. 1978. Effects of Petroleum on Different Stages of Incubation in Bird Eggs. Bull. Env. Contam. Toxicol. 19: 624-630.

Allen, G.H. 1964. An Oceanographic Study Between the Points of Trinidad Head and Eel River. Resources Agency of California State Water Qual. Contr. Bd. Sacramento, CA publ. no. 25, 136 p.

AMOCO CADIZ Oil Spill. 1978. Preliminary Scientific Report. NOAA Environmental Research Lab. NOAA/EPA Special Report, USGPO, Washington, D.C.

Anderson, J.W. 1975. Laboratory Studies on the Effects of Oil in Marine Organisms: An Overview. American Petroleum Institute. Publ. No. 4249.

Anderson, K. and J. North. 1966. In situ Studies of Spore Production and Dispersal of the Giant Kelp Macrocystis. Proc. Vth Intl. Seaweed Sump., Pergamon, pp. 73-86.

Angelici, G.L., N.A. Bryant, R.K. Fretz, and S.Z. Friedman. 1980. Urban Solar Photovoltaics Potential. An Inventory and Modeling Study Applied to the San Fernando Valley Region of Los Angeles. NASA, JPL Publ. 80-43 Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA.

Anonymous. 1982. Exploration Development U.S.A., in: OCJ Report Oil and Gas Journal, vol. 80, no. 25.

Anonymous. 1982. Sasol Makes Motor Fuel from Coal. Engineering and Mining Journal, vol. 183, no. 11.

Atlas, R.M. and R. Bartha. 1972. Biodegradation of Petroleum in Seawater at Low Temperatures. Can. J. Microbiol. 18:1851-1855.

Atlas, R.M. 1975. Effects of Temperature and Crude Oil Composition on Petroleum Biodegradation. Appl. Microbiol. 30: 396-403.

Atlas, R.M. 1981. Microbiol. Degradation of Petroleum Hydrocarbons: an Environmental Perspective. Microbiol. Rev. 45:180-209.

Atwater, T.M. 1970. Implications of Plate Tectonics for the Cenozoic Tectonic Evolution of Western North America, Geological Society of America, Geological Society of America bull., vol. 81, no. 12, pp. 3513-3536.

Augenfeld, J.M. et al. 1982. The fate of Polyaromatic Hydrocarbons in an Intertidal Sediment Exposure System: Bioavailability to Macoma inquinata (Mollusca; Pelyeypoda) and Abarenicola pacifica (Anneldida: Polychaeta). Mar. Environ. Res. 7:31-50.

Ayers, R.C., Jr., R.P. Meek, T.C., Jr., D.O. Stuebner. 1980. An Environmental Study to Assess the Effect of Drilling Fluids on Water Quality Parameters during High Rate, High Volume Discharges to the Ocean. In: Symp. on Res. on Environmental Fate and Effects of Drilling Fluids and Cuttings. Jan. 21-24, 1980., Lake Buena Vista, FL.

Baker, J.M. 1970. The Effects of Oil on Plants. Environmental Pollution 9(1):27-44.

Baker, J.M. 1971a. The Effects of a Single Oil Spillage. In: E.B. Cowell (ed). The Ecological Effects of Oil Pollution in Littoral Communities, London, Elsevier, pp. 16-20.

Baker, J.M. 1971b. Growth Stimulation Following Oil Pollution. In: E.B. Cowell (ed). The Ecological Effects of Oil Pollution in Littoral Communities, London, Elsevier, pp. 72-77.

Becasia, A., J. Isakson, A. Redfield, M. Blaylock, H. Finney, R. Frew, D. Lees, D. Petrula, R. Godwin. 1981. Pacific Coast Ecological Inventory, U.S. Fish and Wildlife Service. National Coastal Ecosystems Team, NASA -Slidell Computer Complex, Slidell, LO, maps, 159 pp.

Bell, R.R. and J.R.R. Ally. 1972. California Water Quality Control Planning Program. California Department of Fish and Game Appendix Report Ocean Area (mimeographed).

Belmor, R. 1983. Corps of Engineers, LA District. Personal Communication, January 19.

Bender, M.E., A.E. Shearls, R.P. Ayres, C.H. Hershner and R.J. Huggett. 1977. Ecological Effects on Experimental Oil Spills on Eastern Coastal Estuarine Ecosystems. In: Proc. 1977 Oil Spill Conf. pp. 505-509.

Benz, C.T. and G.C. Kobetich. 1980. Southern Sea Otter Recovery Plan. Technical Review Draft. U.S. Fish and Wildlife Service.

Berdugo, V. et al. 1977. The Effect of Petroleum Hydrocarbons on Reproduction of an Estuarine Planktonic Copepod in Laboratory Cultures. Mar. Pollut. bull. 8:138-143.

Berkner, A. 1982. Personal Communication. Seabird Rescue Center.

Birkhead, T.R. et al. 1973. Oil Seabirds Successfully Cleaning their Plumage. Brit. Birds, 66:535-537.

Blaney-Dynett. 1981. The Impacts of Proposed OCS Lease Sale No. 68 on Public Services in Santa Barbara and Ventura Counties. POCS Technical Paper No. 81-4. B Contract No. YN010-CT1-1, prepared by Blayney-Dyett, Urban and Regional Planners, San Francisco, CA 111 p.

Blaskovich, D.D. A Drift Card Study in Monterey Bay, California, September 1971-April 1973. Technical Publication 73-4, Moss Landing Marine Laboratories, Moss Landing, CA, p. 79.

Bolin, R.L. and D.P. Abbott. 1963. Studies on the Marine Climate and Phytoplankton of the Central Coastal Area of California, 1954-1960. Calif. Coop. Oceanic Fish. Invest., Rep. 9:23-45.

Bolt, B.A., Lomnitz, Cinna, and T.V. McEvilly. 1968. Seismological Evidence on the Tectonics of Central and Northern California and the Mendocino Escarpment. Seismological Society of America bull., vol. 58, no. 6, pp. 1725-1767.

Bolt, B.A., W.L. Horn, G.A. Macdonal, and R.F. Scott. 1975. Geological Hazards, Springer-Verlag, New York, NY, 328 p.

Bourne, W.R.P. 1971. Atlantic Puffin Decline. Smithson. Inst. Center for Short-Lived Phenomena. Ann. Rept. 83-71.

Boyd, M.J. 1982. Personal Communication. Humboldt State University, Arcata, CA.

Bright, D.B. 1974. Benthic Invertebrates of the Southern California Coastal Zone and Offshore Areas. Southern California Ocean Studies Consortium.

Broenkow, W.W. and W.M. Sonethine, Jr. 1978. Surface Circulation and Replacement of Water in Monterey Bay. Estuarine Coastal Mar. Sci., 6:583-603.

Brown, R.D. Jr. and E.W. Wolfe. 1972. Map showing recently active breaks along the San Andreas Fault between Pt. Delgada and Bolinas Bay, California. U.S. Geological Survey. Miscellaneous Geological Investments, Map I-692.

Brown, R.P. 1970. Summary of Ocean Dumping in the California Bight 1931-1971, prepared for the Southern California Coastal Water Research Project.

Bryan, G.W. and L.G. Hummerstone. 1971. Adaptation of the Polychaete, Nereis diversicolor, to Estuarine Sediments containing High Concentrations of Heavy Metals. I. General observation and Adaptations to Copper. J. Mar. Biol. Assoc. U.K. 51:845-863.

Bureau of Land Management. 1975. Final Environmental Impact Statement for Proposed 1975 Outer Continental Shelf Oil and Gas Lease Sale Offshore

Southern Califonria, OCS Lease Sale No. 35, U.S. Department of the Interior, Pacific OCS Office, Los Angeles, CA, 5 vols., 3276 p.

Bureau of Land Management. 1979. Final Environmental Impact Statement for Proposed 1979 Outer Continental Shelf Oil and Gas Lease Sale Offshore Southern California, OCS Sale No. 48, U.S. Department of the Interior, Pacific OCS Office, Los Angeles, CA, 5 vols., 2384 p.

Bureau of Land Management. 1980. Final Environmental Impact Statement, Proposed 1981 Outer Continental Shelf Oil and Gas Lease Sale Offshore Central and Northern California, OCS Sale No. 53. U.S. Department of the Interior, Pacific Outer Continental Shelf Office, Los Angeles, CA, 750 p.

Bureau of Land Management. 1981b. Final Environmental Impact Statement for Proposed 1982 Outer Continental Shelf Oil and Gas Lease Sale Offshore Southern California OCS Sale No. 68, U.S. Department of the Interior, Pacific OCS Office, Los Angeles, CA, 507 832 p.

Bureau of Land Management. 1982. Final Supplement to the Final Environmental Statement. Proposed 5-Year OCS Oil and Gas Lease Sale Schedule. Prepared for the Bureau of Land Management, U.S. Department of the Interior, vol. 1, 583 p.; vol. 2, 507 p.

Burge, R.T. and S.A. Schultz. 1973. The Marine Environment in the Vicinity of Diablo Cove with Special Reference to Abalones and Bony Fishes. California Department of Fish Game Mar. Resour. Tech. Rept. 19:433.

Byrne, C.J. and J.A. Calder. 1977. Effect of the Water-soluble Fractions of Crude, Refined and Waste Oils on the Embryonic and Larval Stages of the Quahog Clam Mercenaria sp. Mar. Biol. 40:225-231.

California Air Resources Board. 1981. California Air Quality Data. Summary of 1981 Air Quality Data, Gaseous and Particulate Pollutants. Published by the California Air Resources Board, Sacramento, CA, 150 p.

California Coastal Commission. 1981. California Coastal Access Guide.

CalCOFI (California Cooperative Oceanic Fisheries Investigations). 1963. Atlas No. 1, Atlas of Temperature and Salinities, 1949-1959. Calif. Nat. Res. Comm.

California Department of Finance. 1979. Department of Finance, Sacramento, CA.

California Department of Fish and Game. 1964. Ocean Fishing Maps, Sacramento, CA.

California Department of Fish and Game. 1970. The National Resources of Balinas Lagoon, their Status, and Future. Wetland Series, 107 p.

California Department of Fish and Game. 1972. The Natural Resources of Elkhorn Slough, their Present, and Future Use. Wetland Series, 105 p.

California Department of Fish and Game. 1973. The Natural Resources of Humboldt Bay. Wetland Series, 160 p.

California Department of Fish and Game. 1974. The Natural Resources of Eel River Delta. Wetland Series, 108 p.

California Department of Fish and Game. 1974. The Natural Resources of Morro Bay, Wetland Series, 103 p.

California Department of Fish and Game. 1975. The Natural Resources of Bodega Harbor. Wetland Series, 183 p.

California Department of Fish and Game. 1975. The Natural Resources of Lake Earl and the Smith River Delta. Wetland Series, 114 p.

California Department of Fish and Game. 1980. Atlas of California Coastal Marine Resources. Sacramento, CA 134 p.

California Department of Fish and Game Planning Team. 1973. Coastal County Fish and Wildlife Resources and their Utilization. Resources Agency of California Department of Fish Game, 258 p.

California Department of Navigation and Ocean Development. 1977. Assessment and Atlas of Shoreline Erosion Along the California Coast.

California Department of Parks and Recreation. 1971. California Coastline Preservation and Recreation Plan. Sacramento, CA.

California Department of Parks and Recreation. 1979. Underwater Parks Master Plan, Sacramento, CA.

California Office of Tourism. 1971a. The Economic Impact of Travel in California, 1979. Sacramento, CA.

California Office of Tourism. 1981b. Local Tourism Promotion Programs. Sacramento, CA.

Carefoot, T. 1977. Pacific Seashores. A Guide to Intertidal Ecology. J.J. Douglas Ltd. Vancouver, 208 p.

Carlisle, J.G., Jr., C.H. Turner, and E.E. Ebert. 1964. Artificial Habitat in the Marine Environment. California Department of Fish and Game. Fish bull. 124.

Centaur Associates, Inc. 1981. Assessment of Space and Use Conflicts between the Fishing and Oil Industries. Vols. I-IV. Prepared for the Bureau of Land Management, New York Outer Continental Shelf Office, New York, NY., (Contract No. AA-551-CT9-26).

Center for Coastal Marine Studies, University of California - Santa Cruz, 1980. (Was Bonnell, et al., 1980, in previous EIS). Summary of Marine Mammal and Seabird Surveys of the Southern California Bight Area 1975-1978, Vol II Synthesis of Findings. Published by University of California at Santa Cruz under Bureau of Land Management, Contract No. AA550-CT7-36.

Center for Coastal Marine Studies, University of California - Santa Cruz. Dohl, T., M. Bonnell, R. Guess, K. Briggs, 1982. Annual Progress Report Part II. Marine Mammal and Seabird Study, Central and Northern California, for Bureau of Land Management POCS, U.S. Department of the Interior, Contract AA551-C79-33, 213 p.

Cerniglia, C.E. et al. 1980. Oxidation of Naphthalene by Cyanobacteria and Microalgae. J. Gen. Microbiol. 116:495-500.

Chambers, Consultants and Planners. 1980. Marine Biological Study of the Point Arguello boathouse area. Air Force Systems Command. Los Angeles, CA. Report No. SD-TR-80-30, 324 p.

Chan, G. 1972. A Study of the Effects of the San Francisco Oil Spill on Marine Organisms. Part 1. Kentfield, CA, College of Marin, 79 p.

Chan, G. 1973. A study of the Effects of the San Francisco Oil Spill on Marine Organisms, pp. 741-781. In: Proceedings of the Joint Conference on Prevention and Control of Oil Spills. American Petroleum Institute, Washington, D.C.

Chan, G. 1975. A Study of the Effects of the San Francisco Oil Spill on Marine Life, Part II: recruitment, pp. 457-461. In: Proceedings of the Joint Conference on Prevention and Control of Oil Pollution. American Petroleum Institute, Washington, D.C.

Chan, G. 1977. The 5-Year Recruitment of Marine Life after the 1971 San Francisco Oil Spill. pp. 543-545. In: 1977 Oil Spill Conference, American Petroleum Institute, Washington, D.C.

Chen, K.Y., S.K. Gupta, A.Z. Sycip, J.C.S. Lu. 1976. Research Study on the Effect of Dispersion, Setting, and Resedimentation on Migration of Chemical Constituents during Open-water Disposal of Dredged Materials. Univ. So. Calif., Los Angeles. Pub. by U.S. Army Eng. Waterways Exp. Stn., Vicksburg, Miss., Contract Rep. D-76-1.

Clark, R.B. In Press. Impact of Oil Pollution on Seabirds.

Collingnon, M.A. 1981. Pacific Index (November 1980-June 1981). U.S. Geological Survey Open-File Report 81-708.

Collings, K.M., C.A. McCord, A. Stadnychenko and P. Yoskin. 1982. Pacific Summary Report 2. A Revision of Outer Continental Shelf Oil and Gas Activities in the Pacific (Southern California) and their onshore impacts. A Summary Report May 1980 U.S. Geological Survey Open-File Report 82-21.

Colwell, R.R. and J.D. Walker. 1977. Ecological Aspects of Mircrobiol. Degradation of Petroleum in the Marine Environment. Crit. Rev. Microbiol. 5:423-445.

Compton, R.R. 1966. Granitic and Metamorphic Rocks of the Salinian Block, California Coast Ranges. In: Bailey, E.H., ed., Geology of Northern California, California Division of Mines and Geology Bulletin 190, pp. 277-287.

Coney, P.J. 1981. Accretionary Tectonics in Western North America. In: Dickinson, W.R. and Payne, W.D., eds., Relations of Tectonics to Ore Deposits in the Southern California Arizona Geological Society Digest vol. 14.

Conomos, T.J. 1970. Movement of Seabird Drifters in the San Francisco Bay Estuary and the Adjacent Pacific Ocean, a Preliminary Report. U.S. Geol. Survey, Circ. 637B, p. 8.

Coon, N.C. et al. 1979. No. 2 Fuel Oil Decreases Embryonic Survival of Great Blackbacked Gulls. Bull. Env. Contam. Toxicol. 21:152-156.

Corner, E.D.S. 1978. Pollution Studies with Marine Plankton. Part 1. Petroleum Hydrocarbons and Related Compounds. Adv. Mar. Biol. 15:289-380.

Costa, D.P. and G.L. Kooyman. 1980. Effects of Oil Contamination in the Sea Otter, Enhydra Lutris. Report. Outer Continental Shelf Environmental Assessment Program, NOAA, Alaska.

Costa, D.P., G. L. Kooyman. 1982. Oxygen Consumption, Thermo Regulation, and the Effect of Fur Oiling and Washing on the Sea Otter Enhydra lutris, Canadian Journal of Zoology 60.

Courtesy Associates. 1980. Symposium on Research on Environmental Fate and Effects of Drilling Fluids and Cuttings. Vol. I and II. Janurary 21-24, 1980. Lake Buena Vista, FL. Courtesy Assoc., Wash., D.C.

Cowles, C., D. Hansen, J. Hubbard. 1981. Types of Potential Effects of Offshore Oil and Gas Development on Marine Mammals and Endangered Species of the Northern Bering Sea, and Arctic Ocean, Technical Paper No. 9. Bureau of Land Management, U.S. Department of the Interior, Alaska Outer Continental Shelf Office, 23 p.

Cubit, J. 1969. Behavior and Physical Factors Causing Migration and Aggregation of the Sand Crab (Emerita analoga) (Stimpson). Ecol. 50(1):118-123.

Curray, J.R. 1966. Geological Structure on the Continental Margin, from subbottom profiles, Northern and Central California. In: Bailey, E.H., ed., Geology of Northern California, California Divison of Mines and Geology bull. 190, pp. 337-342.

Danenberger, E.P. 1980. Outer Continental Shelf Oil and Gas Blowouts. U.S. Geological Survey Open-File Report 80-101, 13 p.

Dames and Moore. 1971. National Shoreline Study California Regional Inventory. U.S. Corps of Engineers.

Dames and Moore. 1980. Comments on Draft Environmental Impact Statement for OCS Lease Sale No. 53. In: USDI, Draft Environmental Impact Statement for OCS Lease Sale No. 53, 1980, Vol. 1.

Dames and Moore. 1981. Fate and Effects of Drilling Fluids and Cuttings Discharges in Lower Cook Inlet, Alaska, and on Georges Bank. Final Report.

Dames and Moore. In Press. Biological Survey conducted for Chevron, U.S.A. for Exploratory Drilling off Point Conception.

Darnell, R.M. 1961. Trophic Spectrum of an Estuarine Community Based on Studies of Lake Pontchartrain. LA., Ecology 42(3):553-568.

Davis, F.F. 1966. Economic Mineral Deposits in the Coast Ranges. In: Bailey, E.H., ed., Geology of Northern California. California Division of Mines and Geology bull. 190, pp. 315-321.

Davis, J.E. and S.S. Anderson. 1976. Effects of Oil Pollution on Breeding Grey Seals. March Pollut. Bull. 7:115-8.

Dayton, P.K. 1971. Competition, Disturbance, and Community Organization: the Provision and Subsequent Utilization of Space in a Rocky Intertidal Community. Ecol. Monogr. 41:351-389.

de Carli, R. 1982. Personal Communication, Planner, County of San Luis Obispo.

De Marini. 1978. Personal Communication. Humboldt State University. Arcata, CA.

Dickert, P.F. 1966. Tertiary Phosphatic Facies of the Coast Ranges In: Bailey, E.H., ed., Geology of Northern California, California Division of Mines and Geology bull. 190, pp. 289-304.

Dienes, L. and T. Shabad. 1979. The Soviet Energy System. V.H. Winston & Sons, Washington, D.C.

Dillion, W.P., J.A. Grow and C.K. Paull. 1980. Unconventional Gas Hydrate Seals may trap gas off Southeast U.S., Oil and Gas Journal, January 7 issue, pp. 124-130.

Dorman, C.E. 1968. The Southern Monterey Bay Littoral Cell: A Preliminary Sediment Budget Study. M.S. Thesis, Naval Postgraduate School, Monterey, p. 234.

Dott, R.H. Jr and R.L. Batten. 1976. Evolution of the Earth. McGraw-Hill Book Co. New York, NY, 504 p.

Dow, P. 1982. Personal Communication, Mendocino County, Department of Public Works.

Eaton, P. 1966. Crustal Structure in Northern and Central California from Seismic evidence. In: Bailey, E.H., ed. Geology of Northern California. California Division of Mines and Geology bull. 190, pp. 419-426.

Edwards, B.D., M.E. Field, and E.C. Clukey. 1980. Geological and Geotechnical Analysis of a Submarine Slump, California Borderland Offshore Technology Conference Proceedings Paper OTC 3726, pp. 399-403.

Emery, K.O. 1960. The Sea Off Southern California. John Wiley and Sons, New York, N.Y.

Englehardt, F.R. et al. 1977. Uptake and Clearance of Petroleum Hydrocarbons in the Ringed Seal Phoca Hispida. J. Fish. Res. Bd. Canada 34:1143-1147.

Englehardt, F.R. 1978. Petroleum Hydrocarbons in Arctic Ringed Seals, Phoca hispida, following Experimental Oil Exposure, pp. 614-628. Proceedings Conference on Assessment of Ecological Impacts of Oil Spills, American Institute of Biological Sciences, Keystone, CO.

ERCO, Inc. 1980. Results of the Joint Bioassay Monitoring Program. Final Report to the Offshore Operators Committee under Direction of Exxon Production Research Co., Houston, TX, ERCO, Inc. Cambridge, MA.

Estes, J. 1981. The Case of the Sea Otter. In Problems in Management of Locally Abundant Wild Mammals, P. Jewell and S. Holt, Ed. Academic Press. 167-180.

Executive Office of the President. 1977. The Natural Energy Plan; Energy, Policy, and Planning, U.S. Govt. Printing Office, Washington, D.C.

Falk, M.R. and M.J. Lawrence. 1973. Seismic Exploration: Its Nature and Effect on Fish. Can. Fish. Mar. Serv. Tech. Rep. Ser. No. CEN-T-73-9, 51 p.

Falk-Peterson, I.B. 1979. Toxic Effects of Aqueous Extracts of Ekofish Crude Oil, Crude Oil Fractions, and Commercial Oil Products on the Development of Sea Urchin Eggs. Sarsia 64:161-169.

Field, M.E., S.H. Clarke Jr., and M.E. White. 1980. Geology and Geologic Hazards of Offshore Eel River Basin, Northern California Continental Margin, U.S. Geological Survey Open-File Report 80-1080.

Field, M.E. and J.V. Gardner. 1980. Shale Diapirism on the Northern California Margin. Geological Society of America, abstract for Atlanta meeting.

Field, M.E., J.V. Gardner, A.E. Jennings, and B.D. Edwards. In Press. Earthquake - Induced Sediment Flows on a 0.25° Slope, Klamath River Delta, California - Geology (18 mms p., 5 figs).

Filby, R.H. and K.R. Shah. 1971. Mode of Occurrence of Trace Elements in Petroleum and Relationship to Oil Spill Identification Methods. In: Proc. Am. Nuclear Soc. Mtg.: Nuclear Methods in Environmental Research. J.R. Vogt, T.F. Parkinson and R.L. Carter (ed.) University of Missouri.

Form and Substance, Inc. 1983a. Air Quality Impacts of Proposed OCS Sale No. 73 Offshore Central and Northern Califonria. Pacific OCS Technical Paper No. 82-7. Draft Report (Contract No. AA851-CTI-44). November 1982.

Form and Substance, Inc. 1983b. A Handbook for Estimating the Potential Air Quality Impacts Associated with Oil and Gas Development Offshoe California. Prepared for U.S. Department of the Interior Minerals Management Service, Contract No. AA851-CT1-44, January 1983.

Foster, M.S., M. Neuschul, and R. Zingmark. 1971. The Santa Barbara Oil Spill, Part 2. Initial Effects on Intertidal and Kelp. Ocean Pollution. 2:115-134.

Foster, M.S. 1974. The Santa Barbara Oil Spill. A Review of Damage to Marine Organisms. Report to Dept. of Justice, State of California, Contract No. 455 (mimeographed).

Foster, P. 1982. Personal Communication. Pacific Missile Test Center.

Fredrickson, D.A., et al. 1977. Vol. VII, Historical and Archaeological Resources. In: A summary Knowledge of the Central and Northern California Coastal Zone and Offshore Areas. Vol. III, Socioeconomic Conditions, Eureka, Winzler and Kelly. Prepared for the Bureau of Land Management (Contract AA550-CT6-52).

Frey, H.W. 1971. California's Living Marine Resources and their Utilization. California Department of Fish and Game, 148 p.

Future's Group, The, and World Information Systems. 1982. Outer Continental Shelf Oil Spill Probability Assessment. Prepared for the U.S. Dept. of the Interior, Bureau of Land Management. Contract AA851-CTO-69.

Gales, R.S. 1981. Study of the Effects of Sound on Marine Mammals, National Ocean Systems Center.

Gallaway, B.J., L.R. Martin, R.L. Howard, G.S. Boland, G.S. Dennis. 1980. Effects of Artificial Reef and Demersal Fish and Macrocrustacean Communities. In: Environmental Effects of Offshore Oil Production. The Buccaneer Gas and Oil Field Study, Middleton, B.S. (ed.), Plenum Press, New York, NY.

Gawthrop, W.H. 1975. Seismicity of the Central California coastal region. U.S. Geological Survey Open-File Report 75-134, 87 p.

Geraci, J.R. and T.G. Smith. 1976. Direct and Indirect Effects of Oil on Ringed Seals (*Phoca hispida*) of the Beaufort Sea. J. Fish. Res. Bd. Can. 33:1976-1984.

Geraci, J.R. and G. Smith. 1977. Consequences of Oil Fouling on Marine Mammals in Malins, Donald C., Effects of Petroleum on Arctic and Subarctic Marine Environments and Organisms, Vol. II, Academic Press, New York, NY, 500 p.

Geraci, J.R., D.J. St. Aubin. 1980. Offshore Petroleum Resource Development and Marine Mammals: A Review and Research Recommendations, Marine Fisheries Review, November 1980, pp. 1-12.

Geraci, J.R. and D.J. St. Aubin. In Press. Offshore Petroleum Resource Development and Marine Mammals: A Review and Research Recommendation. Mar. Fish. Rev.

Geraci, J.R., D.J. St. Aubin. 1982. Study of Effects on Oil on Cetaceans for Bureau of Land Management, U.S. Department of the Interior, Contract No. AA551-CT9-29.

Geraci, J.R. and D.J. St. Aubin. In Press. Offshore Petroleum Resource Development and Marine Mammals: A Review and Research Recommendation. Mar. Fish. Rev.

Gorman, M.L and C.E. Sims. 1978. Lack of Effect of Ingested Forties Field Crude Oil on Aurian Growth. Mar. Pollut. bull. 9:273-276.

Grau, C.R. et al. 1977. Altered Yolk Structure and Produced Hatcability of Eggs from Birds Fed Single Doses of Petroleum Oils. Science, 195:779-781.

The Granville Corporation. 1981. POCS Technical Paper 81-5 California Coastal Recreation and Aesthetic Resources, published as POCS Technical Paper No. 81-5. Prepared for the Bureau of Land Management, Pacific OCS Office, Los Angeles, CA (Contract AA-851-CTO-63), 658 p.

Grassle, J.F. et al. 1981. Response of Benthic Communities in MERL Experimental Ecosystems to Low Level Chronic Additions of No. 2 Fuel Oil. Mar. Environ. Res. 4:279-297.

Green, H.G., W.H. Lee, D.S. McCulloch, and E.E. Brabb. 1973. Faults and Earthquakes in the Monterey Bay Region, California. U.S. Geological Survey Miscellaneous Field Study MF-518, 14 p.

Gress, F., D. Anderson. 1982. Draft, The California Brown Pelican Recovery Plan, U.S. Fish and Wildlife Service, Portland, OR, 147 p.

Guilbert, J.M. 1981. A Piate Tectonic-Lithotectonic Classification of Ore Deposits. In: Dickinson, W.R. and Payne, W.D., eds. Relations of Tectonics to Ore Deposits in the Southern Cordillera Arizona Geological Society Digest, vol. 14.

Gundlach, E. and M. Hayes. 1978. Vulnerability of Coastal Environments to Oil Spill Impacts. Marine Technology Society Journal 12(4):18-27.

Hancock, D. 1977. Benthic Fauna. In: A Summary of Knowledge of the Central and Northern California Coastal Zone and Offshore Areas. Bureau of Land Management, Contract No. AA550-CT6-52.

Hardy, J.T. 1977. Benthic Flora. In: A Summary of Knowledge of the Central and Northern California Coastal Zone and Offshore Areas. Bureau of Land Management, Contract AA550-CT6-52.

Hardy, R.A. 1972. A Survey of the Marine Environment Near the City of Santa Cruz Ocean Outfall. California Department of Fish and Game, Marine Resources Region, Long Beach, CA, 16 p.

Hardy, R.A. 1973. A Survey of the Marine Environment Near the City of Marine Resources Region, Long Beach, CA, 26 p.

Harmuth, B. 1982. Personal Communication. Port Hueneme Expansion.

Heath, J. 1981. Personal Communication, Planner, Mendocino County.

Hebert, R. and S.A. Poulet. 1980. Effect of Modification of Particle Size of Emulsions of Venezuelan Crude Oil on Feeding, Survival and Growth of Marine Zooplankton. Mar. Environ. Res. 4:121-134.

Hickey, B.M. 1978. The California Current System - Hypotheses and Facts: Dept. of Oceanography, University of Washington, Seattle, WA, p. 96.

Hofweber, T. 1981. Personal Communication, Planner Humboldt County.

Hollister, T.A. et al. 1980. Acute Toxicity of a No. 6 Fuel Oil to Marine Organisms. Bull. Environ. Contam. Toxicol. 24:656-661.

Holmes, W.N and J. Cronshaw. 1977. Biological Effects of Petroleum on Marine Birds in Malins, Donald C., Effects of Petroleum on Arctic and Subarctic Marine Environments and Organisms, Vol II, Academic Press, New York, NY, 500 p.

Holton, R.L, R.D. Leatham and G.F. Crandell. 1977. Zooplankton. In: Summary of Knowledge of the Central and Northern California Coastal Zone and Offshore Areas, Winzler and Kelley, Eureka. BLM Contract AA550-CT6-52.

Hooks, McCloskey and Associates. 1982. Biological Survey of Megafaunal Species on or in the Vicinty of Leases OCS-P0404, P0405, P0410, and P9411 in the Santa Maria Basin Offshore Lease Sale Area. Prepared for Exxon Company, U.S.A.

Hope Jones, P. et al. 1978. Birds Oiled During the Amoco Cadiz Incident -an Interim Report. Mar. Pollut. bull. 9:307-310.

Horowitz, A. et al. 1975. Sequential Growth of Bacteria on Crude Oil. Appl. Microbiol. 30:10-19.

Hoskins, E.G. and J.R. Griffiths. 1971. Hydrocarbon Potential of Central and Northern California Offshore. American Association of Petroleum Geologists, Memoir 15 vol. 1, pp. 218-228.

Huang, J.C.K. 1972. Recent Decadal Variation in the California Current System. J. of Phys. Oceanogr., 2(4):382-390.

Hudson, J.H. and D.M. Robbin. 1980. Effects of Drilling Mud on Growth Rate of the Reef-Building Coral, Montastraea annularis. In: Symposium on Research on Environmental Fate and Effects of Drilling Fluids and Cuttings January 21-24, 1980., Lake Buena Vista, Florida. Proceedings. Courtesy Assoc. Washington, D.C.

Humboldt, County of. 1980. Initial Siting Study for OCS Support Facilities Humboldt County California. Coastal Energy Impact Program Issue Paper No. 2, Draft Staff Report.

Humboldt, County of. 1981. Industrial Siting Study. Coastal Energy Impact Program, Issue Paper No. 3, Draft Technical Study.

Hutchinson, L.V. and B. Wenzel. 1980. Olfactory Guidance in Foraging by Procellariforms, Condor 82:314-319.

Idia, K., D.C. Cox and G. Pararas-Carayannis. 1967. Preliminary Catalog of Tsunamis Occurring in the Pacific Ocean. Hawaii Institute of Geophysics, University of Hawaii Data Report No. 5, HIG-67-10.

Inglis, D.R. 1973. Nuclear Energy: Its Physics and its Social Challenge. Addison-Wesley Publishing Company, Reading, MA.

Johns, D.M. and J.A. Pechenik. 1980. Influence of the Water. Accommodated Fraction of No. 2 Fuel Oil on Energetics of Cancer irroratus larvae. Mar. Biol. 55:247-254.

Johnson, J.W. 1972. Tidal Inlets of the California, Oregon, and Washington Coasts. Hydraulic Eng. Lab. Col. Eng. U. Cal. Berkeley HEL 24-12. 156 p.

Johnson, M.A. 1982. Personal Communication, Energy Planner, CEIP.

Johnson, R.G. 1971. Animal-Sediment Relations in Shallow Water Benthic Communities. Marine Geol., 11 (93-104).

Jones and Stokes Associates. 1980. Ecological Characterization of the Central and Northern California Coastal Region. Five volumes. Prepared for U.S. Fish and Wildlife Service Contract No. 14-16-0009-79-043. Preliminary Draft.

Jordan, R.E. and J.R. Payne. 1980. Fate and Weathering of Petroleum Spills in the Marine Environment. Ann Arbor Science, Ann Arbor, MI, 174 p.

Joyner, W.B. and D.M. Boore. 1981. Peak Horizontal Acceleration and Velocity from Strong-Motion Records Including Records from the 1979 Imperial Valley, California, earthquake. Bulletin of Seismological Society of America vol. 71, no. 6, pp. 2011-2038.

Kachadoorian, R. 1968. Effects of the Alaskan Earthquake, March 27, 1964, on the Alaskan Highway System. U.S. Geological Survey Professional Paper 545-C, pp. C1-C66.

Kooyman, G.L., et al. 1977. Thermal Conductance of Immersed Pinniped and Sea Otter Pelts before and after Oiling with Prudhoe Bay Crude. In: Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms. D.A. Wolfe (ed.), Pergamon Press, New York, NY.

Krone, M.A. and D.C. Briggs. 1980. Sublethal Metabolic Responses of the Hermatypic Coral Madracis decactris Exposed and Drilling Mud Enriched with Ferrochrome lognosulfonate. In: Proc. Symp. Res. Environmental Fate and Effects of Drilling Fluids and Cuttings. Jan. 21-24, 1980, Lake Buena Vista, FL, Courtesy Assoc. Washington, D.C.

Kuhnhold, W.W. et al. 1978. Effects of Low Levels of Hydrocarbons on Embryonic Larval and Adult Winter Flounder, Pseudopleuronectes americanus. In: Proc. Conf. Assessment Ecol. Impacts of Oil Spills, June 1978,

Keystone, Colorado, Amer. Inst. Biol. Stud., Wash., D.C. NTLS No. AD-A072-859.

LaBelle, R.P, J. Lanfear and R. M. Karpas. 1983. An Oilspill Risk Analysis for the Central and Northern California (Proposed Sale No. 73) Outer Continental Shelf Lease Area.

Lanfear, K.J., R.A. Smith and J.R. Slack. 1979. An Introduction to the Oil Spill Risk Analysis Model. Proceedings of the 1973 OTC Conference, pp. 2173-2181.

Lanfear, K.J. and D.G. Amstutz. 1982. A reexamination of Oil Spill Occurrence Rates for the U.S. Outer Continental Shelf Interior Report.

LeBoeuf, B.J. 1971. Oil Contamination and Elephant Seal Mortality: A "Negative" Finding, Biological and Oceanographical Survey of the Santa Barbara Channel Oil Spill 1969-1970. Biology and Bacteriology (D. Straughan, ed.) vol. 1. Allan Hancock Foundation, Sea Grant Publ. 2., University of Southern California, Los Angeles, CA, pp. 277-285.

Lee, H.J., B.D. Edwards and M.E. Field. 1981. Geotechnical Analysis of a Submarine Slump Eureka, California. Offshore Technology Conference Proceedings Paper OTC 4121, pp. 53-59.

Lee, R.F. et al. 1978. Short Term Effects of Oil on Plankton in Controlled Ecosystems. In: Proc. Conf. Assessment Ecol. Impacts Oil Spills, June 14-17, 1978, Keystone, CO. Amer. Inst. Biol. Sci., Wash., D.C. NTIS No. AD-A072 859.

Linden, O. 1978. Biological Effects of Oil on Early Development of the Baltic Herring clapea harengus membras. Mar. Biol. 45:273-283.

Linden, O. et al. 1980. The Combined Effect of Salinity, Temperature and Oil on the Growth Pattern of Embryos of the Nillifish, Fundulus heteroclitus (Walbaum). Mar. Environ. Res. 3:129-144.

Lindstedt-Siva, June. 1980. Minimizing the Ecological Impacts of Oil Spills. Environment International, vol. 3, pp. 185-188.

Lipe, W.D. 1977. A Conservation Model for American Archaeology. In: Conservation Archaeology. Michael B. Schiffer and George J. Gumerman, eds. New York, Academic press. pp. 19-42.

Lipschutz, R.D. 1980. Radioactive Waste: Politics, Technology, and Risk. Ballinger Publishing Company, Cambridge, MA.

Littler, M.M. 1979. Intertidal Island Aerial Survey, vol. 5. Report in Southern California Intertidal Survey Year III. Prepared by Science Applications, Inc. for the Bureau of Land Management, Pacific OCS Office, Los Angeles, CA. Contract No. AA551-CT7-44.

Littler, M.M. and D.S. Littler 1980. Southern California Bight Mainland Intertidal Aerial Survey From Pt. Arguello to Pt. Loma. Prepared for

the Bureau of Land Management, Pacific OCS Office, Los Angeles, CA. Contract No. YN010-CT9-4.

Longwell, A.C. 1978. Field and Laboratory Measurements of Stress Responses at the Chromosome and Cell Levels in Planktonic Fish Eggs and the Oil Problem. In: In the Wake of the Argo Merchant. Proc. Symp. Jan., 1978. Center for Ocean Management, Univ. Rhode Island, Kingston, RI.

Lopez, R. 1982. Personal Communication. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of Coastal Zone Management. Washington, D.C.

Lynn, R.J. 1967. Seasonal Variation of Temperature and Salinity at 10 Meters in the California Current. State of California Dept. of Fish and Game Marine Res. Dept. CalCOFI Report v. XI, pp. 157-174.

MacGinitie, G.E. and N. MacGinitie. 1968. Natural History of Marine Animals. Second Edition. McGraw-Hill, New York, NY, 523 p.

Mackie, P.R. et al. 1978. Early Samples of Oil in Water and Some Analyses of Zooplankton. Mar. Pollut. bull. 9:296-297.

Mackin, J.G. 1971. A Study of the Effects of Oil Field Brine Effluents on Biotic Communities in Texas Estuaries. Texas A&M Res. Found. Project 735 Report, November, 72 p.

Macpherson, G.S. and J. Bernstein. 1980. Outer Continental Shelf Oil and Gas Activities in the Pacific (Southern California) and their Onshore Impacts. A Summary Report May 1980, U.S. Geological Survey Open-File Report 80-645.

Malahoff, A. 1981. Comparison Between Glapagos and Gorda Spreading Centers. Offshore Technology Conference Proceedings Paper OTC 4129, pp. 115-117.

Malette, R. 1982. Personal Communication. California Department of Fish and Game, Sacramento Office. Sacramento, CA.

Malins, D.C. (ed.). 1977. Effects of Petroleum on Arctic and Subarctic Marine Environments and Organisms. Vol. I and II. Academic Press, New York, NY.

Malins, D.C. (ed.). 1980. What's Happening to Our Fish? NOAA 10(2):6-9.

Malins, D.C., H. O. Hodgins. 1981. Petroleum and Marine Fishes: A Review of Uptake, Disposition and Effects, Service and Technology, vol. 15, pp. 1272-1280.

Manheim, F.T. and H.D. Hess. 1981. Hard Mineral Resources around the U.S. Continental Margin. Offshore Technology Conference Proceedings Paper OTC 4131, pp. 129-134.

Marin, County of. 1980. Local Coastal Program Unit II Final Hearing Draft. Planning Department.

Marks, A. 1982. Elements of Oil-Tanker Transportaion. Pennwell Publ. Co., Tulsa, OK, 515 p.

Marks, G.W. 1938. The Copper Content and Copper Tolerance of Some Species of Mollusks off the Southern California Coast. Biol. bull. 75:224-237.

Martin, M., D. Crane, T. Lew, W. Seto. 1980. California Mussel Watch 1979-1980. Synthetic Organic Compounds in Mussels, Mytilus californianus, and M. edulis, along the California Coast and selected Harbors and Bays. Part II. State Water Res. Contr. Bd., Water Quality Monitoring Rept. - 80-8, Dec. 1980.

Martz, D.R. and M.M. Littler. 1979. Assessments of the Distribution, Adundance and Community Structure of Rocky Intertidal Organisms at Government Point, vol. II. Prepared by Science Applications, Inc. for Bureau of Land Management, Pacific OCS Office, Los Angeles, CA. Contract No. AA550-CT7-44.

Maurer, R.O. 1976. A Preliminary Report of Zooplankton in the Vicinity of the Argo Merchant Oil Spill. In: The Argo Merchant Oil Spill. A Preliminary Scientific Report. NOAA Special Report, March, 1977, 275 p.

McCulloch, D.S. and M.G. Bonilla. 1970. Effects of the Alaskan Earthquake March 27, 1964 on the Alaskan Railroad. U.S. Geological Survey Professional Paper 545-D, pp. D1-D161.

McCulloch, D.S., S.H. Clarke, Jr., M.E. Field, E.W. Scott, and P.M. Utter. 1977. A Summary Report of the Regional Geology, Petroleum Potential and Environmental Geology of the Proposed Lease Sale 53, Central and Northern California Outer Continental Shelf. U.S. Geological Survey Open-File Report 77-593.

McCulloch, D.S., H.G. Greene, K.S. Heston, and D.M. Rubin. 1980. A Summary Report of the Geology and Geologic Hazards in Proposed Lease Sale 53, Central and Northern California, Outer Continental Shelf. U.S. Geological Survey Open-File Report 80-1095.

McCulloch, D.S., S.H. Clarke, Jr., M.E. Field, and P.A. Utter. In Press. Geology Report for Sale 73 Offshore Central and Northern California. Regional Geology, Petroleum Potential, and Environmental Geology. U.S. Geological Survey Open File Report 82-XX.

McCulloch, D.S. In Press. Geohazards on OCS Lease Sale 73 on the Central California Continental Shelf and Slope. U.S. Geological Survey Administrative Report.

McDaniel, B. 1982. Personal Communication. Port of Long Beach Coal Terminal.

McMullen, J.J. Associates, Inc. 1977. Environmental Impact Report for Point Conception LNG Import Terminal. Vessel Traffic Analysis. Prepared for California Public Utilities.

Mead, C. and S. Ballie. 1981. Seabirds and Oil: The Worst Winter. Nature, London, 292: 10-11.

Mead, W.J. and P.E. Worenson. 1970. The Economic Cost of the Santa Barbara Oil Spill. In: R.W. Holmes and F.A. DeWitt (ed.) Santa Barbara Oil Symposium. December 16, 17, 18, 1970. University of California, Santa Barbara, CA pp. 183-226.

Mendocino, County of. 1980a. Development Scenarios and Siting Options. Prepared by Blayney-Dyett, Urban and Regional Planners.

Mendocino, County of. 1980b. Coastal Element, Mendocino County General Plan, Hearing Draft. Prepared by Blayney-Dyett, Urban and Regional Planners.

Menzie, C., D. Mauer, and W. Leathan. 1980. An Environmental Monitoring Study to Assess the Impact of Drilling Discharges in the Mid-Atlantic, vol. IV. The Effects of Drilling Discharges on the Benthic Community. In: Proceedings of the Symposium: Research on Environemental Fate and Effects of Drilling Fluids and Cuttings. Lake Buena Vista, FL.

Middleditch, B.S. (ed.). 1981. Environmental Effects of Offshore Oil Production. The Buccaneer Gas and Oil Field Study. Marine Science, vol. 14, Plenum Press, New York, NY, 446 p.

Miller, D. and D. Gotshall. 1965. Ocean Sportfish Catch and Effort from Oregon to Point Arguello. California Department of Fish and Game. Fish bull. No. 130:1-135.

Miller, D.A. et al. 1978a. Effects of Ingestion of a Weathered Crude Oil on Immature Black Guillemots, Cepphus grylle, and Herring Gulls, Larus argentatus. Bull. Mt. Desert Ic. Biol. Lab. 17:40-42.

Miller, D.J. and R.N. Lea. 1972. Guide to the Coastal Marine Fishes of California. California Department of Fish and Game. Fish bull. 157, 235 p.

Miller, D.J. and J.J. Geibel. 1973. Summary of Blue Rockfish and Lingcod Life Histories; A Reef Ecology Study; and Giant Kelp, Macrocystis pyrifera Experiments in Monterey Bay, CA. California Department of Fish and Game, Fish bull. 158:137.

Miller, D.J. and R.N. Lea. 1976. Addendum to Guide to the Coastal Marine Fishes of California, Fish. bull. 157, by D.J. Miller and R.N. Lea. California Dept. of Fish and Game, Sacramento, 1972, pp. 236-249.

Miller, D.S. et al. 1978b. Ingestion of Crude Oil: Sublethal Effects in Herring Gull Chicks. Science, 199:315-317.

Miller, M. and K.C. McGrew. 1977. Water Quality; In: A Summary of Knowledge of Central and Northern California Coastal Zone and Offshore Areas, Prepared by Winzler and Kelly Consulting Engineers for BLM/DOI under Contract No. AA550-CT6-52.

Minerals Management Service. On Going. Shipwreck File.

Minerals Management Service. 1982a. Archaeological Analysis for the Proposed OCS Lease Sale No. 73 Area (Central and Northern California) Summary Report. Minerals Management Service, Offshore Environmental Assessment Division, Reston, VA.

Minerals Management Service. 1982b. Gulf of Mexico Draft Regional Environmental Impact Statement.

Morita, R.Y. 1977. The Role of Microorganisms in the Marine Environment. In: N.R. Anderson and B.J. Zahuhanec (eds.) Oceanic Sound Scattering Prediction. Plenum Press, New York, NY.

Mossman, D.L. 1982. Personal Communication. Port of Los Angeles Coal Terminal.

Murray, S.N. 1974. Benthic Algae and Grasses. In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas. The Southern California Ocean Studies Consortium.

Murray, S.N. and M.M. Littler. 1979. Experimental Studies of the Recovery of Populations of Rocky Intertidal Macro-organisms following Mechanical Disturbance. Science Applications, Inc., Tech. Rept. II-2.0 to the BLM. Contract No. AA550-CT7-44 (Year III SCOCS Program), La Jolla, CA.

Murray, S.N., M.M. Littler, and I.A. Abbott. 1980. Biogeography of the California Marine Algae with Emphasison the Southern California Islands, pp. 325-339. In: The California Islands: Proc. of a Multidisciplinary Symposium, Ed. D.M. Powers.

National Academy of Sciences. 1971. Radioactivity in the Marine Environment, Washington, D.C.

National Academy of Sciences. 1972. Research Needs in Water Quality Criteria. National Academy of Sciences, National Academy of Engineering. 1972, 64 p.

National Academy of Sciences. 1975. Assessing Potential Ocean Pollutants, Washington, D.C.

National Geographic Special Report. 1981. Energy, February 1981, Washington, D.C.

National Marine Consultants. 1960. Wave Statistics for Ten Most Severe Storms Affecting Three Selected Stations of Northern California During the Period 1951-1960. Cited in Williams, R.G., et. al., 1980. Climatology and Oceanographic Analysis of the California Pacific OCS.

National Research Council. 1981. Safety and Offshore Oil. National Academy Press, Washington, D.C., 331 p.

Neff, J.M. 1979. Polycyclic Aromatic Hydrocarbons in the Aquatic Environment. Applied Science Publishers LTD, London, 262 p.

Neff, J.M. 1981. Fate and Biological Effects of Oil Well Drilling Fluids in the Marine Environment. A Literature Review. Final Technical Report to U.S. Environmental Portection Agency, Rept. No. 15077.

Neff, J.M. and J.W Anderson. 1981. Response of Marine Animals to Petroleum and Specific Petroleum Hydrocarbons. Applied Science Publishers, LTD, Halsted Press, New York, NY, 177 p.

Nekton, Inc. 1982. A Biological Survey of a Hard Bottom Feature, Santa Maria Basin, CA. Prepared for ARCO Oil and Gas Company, November, 1981.

NERBC/RALI. 1976. Onshore Facilities Related to Offshore Oil and Gas Development, Factbook, November 1976.

Nero and Associates Inc. 1982. Final Report, Seabird-Oil Spill Behavior Study, Vol. I: Executive Summary for Bureau of Land Mangement, U.S. Department of the Interior. Contract No. SBO 408(a)-80-C-550/ AA851-CTO-70, 15 p.

New England River Basins Commission. 1976. Onshore Facilities Related to Offshore Oil and Gas Development, Factbook NERBC-RALI Project, NERBC, November, 1976

Newswanger, 1980. Personal Communication. In: Chambers Consultants and Planners.

Nicol, J.A.C. et al. 1977. Chemical Composition and Effects of Water Extracts of Petroleum on Eggs of the Sand Dollar Melitta quinquiesperfurata. Mar. Biol. 40:309-316.

North, J. 1971. Introduction and Background pp. 1-97. In: The Biology of Giant Kelp Beds (Macrocystis) in California. (ed.) W.J. North. Berhefte Zur Nova Hedwigia Heft 32.

Oedemar, M.W., P.W. Wild and K.C. Wilson. 1968. A Survey of the Marine Environment From Fort Ross, Sonoma County, to Point Lobos, Monterey County. California Fish and Game, Marine Resources Operations, Long Beach, CA. MRO ref. no 68-12. 238 p.

Ogle, B.A. 1953. Geology of Eel River Valley area Humbolt County, California. California Division of Mines and Geology bull. 164, 128 p.

Oritsland, N.A. et al. 1981. Effect of Crude Oil on Polar Bears. U.S. Department of Indian Affairs and Northern Development Canada Publ. No. QS-8283-020-EE-Al (in press).

Oshida, P. 1977. A Safe Level of Hexavalent Chromium for a Marine Polychaete. So. Calif. Coastal Water Res. Proj. Ann. Rept. 1977.

Oshida, P. and T.K. Goochey. 1980. A New Test for Measuring Seawater Toxicity. Coastal Water Res. Proj. Biennial Rept. 1979-1980. Southern Calif. Coastal Water Res. Proj., Long Beach, CA.

Ott, F.S. et al. 1978. Acute and Sublethal Toxicity of Naphthalene and Three Mgthylated Derivatives to the Estuarine Copepod, Eurytemora affinis. Mar. Environ. Res. 1:49-58.

Pacific Boating Almanac. 1981a. Northern California and Nevada. Western Marine Enterprises, Inc. Ventura, CA.

Pacific Boating Almanac. 1981b. Southern California, Arizona, and Baja. Western Marine Enterprises, Inc. Ventura, CA.

Pacific Fishery Management Council. 1982. Final Fishery Management Plan and Supplemental Environmental Impact Statement for the Washington, Oregon and California Groundfish Fishery. Portland, OR.

Pacific Marine Fisheries Commission. 1982. Marine Recreational Fishery Statistics Survey. A Description of Survey Methodology and Review of the Data Collected.

Page, B.M. 1970. Sur-Nacimento Fault Zone of California Continental Margin Tectonics. Geological Society of America bull. vol. 81. no. 3, pp. 667-690.

Page, et al. 1979.

Perry, M. 1982. Personal Communication, Planner, Sonoma County.

Peterson, R.S., and M.W. Odemar. 1969. Population Growth of the Sea Otter in California, pp. 69-72. In: Sixth Ann. Conf. on Biol. Sonar and Diving Mammals, Stanford Res. Inst., Menlo Park, CA. Proc.: 1-113.

Petrazullo, G. 1981. An Environmental Assessment of Drilling Fluids and Cuttings Released onto the Outer Continental Shelf for the Gulf of Mexico. Prepared by: Industrial Permits Branch, Office of Water Enforcement and the Oceans Program Branch, Office of Water Management.

Petroleum Transportations Committee. 1982. Phase J Report Draft for Comment Volume I Text County of Santa Barbara, Resource Management Department.

Pirie, D.M., M.J. Murphy, and J.R. Edmisten. 1975. California Nearshore Surface Currents. Shore and Beach, 43(2): 23-34.

Pirie, D.M. and D.D. Steller. 1974. California Coast Nearshore Processes Study Final Report. ERTS-1 Experiment 088, Goddard Space Flight Center, Greenbelt, MD, 148 p.

Pomeroy, L.R. 1980. Microbial Effects of Aquatic Food Webs. In: D. Schlessinger (ed.) Microbiology-1980. Amer. Soc. for Microbiology, Washington, D.C.

Radian Corporation. 1982. Assessment of NO_x Control Measures for Diesel Engines on Offshore Exploratory Drilling Vessels and Rigs, Final Report. Presented to The Joint Industry/Government Task Force. July 1982.

Ralls, K., J. Ballou, and R.L. Brownell, Jr. In Press. Genetic Diversity in California Sea Otters: Theoretical Considerations and Management Implications. Biological Conservation.

Ray, J.P., and R.P. Meek. 1980. Water Column Characterization of Drilling Fluids Dispersion from an Offshore Exploratory Well on Tanner Bank. In: Symp. Res. Enviorn. Fate and Effects of Drilling Fluids and Cuttings, Jan. 21-24, 1980, Lake Buena Vista, FL.

Reed, R.D. 1933. Geology of California. American Association of Petroleum Geologists, Tulsa, OK, 355 p.

Reid, J.L., Jr., G.L. Roden, and J.G. Wyllie. 1958. Studies of the California Current System. Calif. Coop. Fish. Invest., Prog. Rep., 1 July to 1 Jan. 1958, pp. 27-57.

Reish, D.J., J.M. Martin, F.M. Piltz, J.L. Word. 1976. The Effect of Heavy Metals on Laboratory Populations of two polychaetes with Comparisons to the Water Quality Conditions and Standards in Southern California Marine Waters. Wat. Res. 10:299-302.

Restrepo and Associates. 1982. IXTOC I Oil Spill Economic Impact Study. Prepared for Bureau of Land Management, New Orleans OCS Office, New Orleans, LA (Contract No. AA-851-CTO-65).

Rice, S.D. 1973. Toxicity and Avoidance Tests with Prudhoe Bay Oil and Pink Salmon Fry. In: Proceedings of Joint Conference on Prevention and Control of Oil Spills. Amer. Petr. INst., EPA and USCG, pp. 667-671.

Richmond, C. and D.J. Burdick. 1981. Geologic Hazards and Constraints of Offshore Central and Northern California. Offshore Technology Conference, Proceeding's Paper OTC 4117, pp. 9-13.

Ricketts, E.F., J. Calivin and J.W. Hedgpeth. 1968. Between Pacific Tides. 4th Ed. Stanford Unviversity Press. 614 p.

Rieble, D.D. and F.H. Shair. 1981. Tracer Investigations of Atmospheric Transport into, within, and out of the Santa Barbara Channel and the Coastal Areas of Santa Barbara and Ventura Counties. California Institute of Technology, Pasadena, CA, January 1981.

Rinkevich, B. and Y. Loya. 1977. Harmful Effects of Chronic Oil Pollution on a Red Sea Coral Population. In: Proc. Third Interntl. Coral Reef Symp. II. Geology. (Taylor, D.L ed.), Univ. Miami, Miami, FL.

Rinkevich, B. and Y. Loya. 1979. Laboratory Experiments on the Effects of Crude Oil on the Red Sea Coral Stylophora pistillata. Mar. Pollut. bull. 10:328-330.

Risebrough, R.W. 1978. Pollutants in Marine Mammals and Recommendations for Research. Manuscript Submitted to the Marine Mammal Commission. Unpublished.

Risebrough, R.W. et. al. 1979. California Mussel Watch: 1977-1978, v. III. Organic Pollutants in Mussels Mytilus californianus and M. edulis, Along the California Coast. State of Calif. Water Resources Control Board Water Quality Monitoring Report No. 79-22.

Riznyk, R. 1977. Phytoplankton. In: R. Dornhelm (ed.), A summary of Knowledge of the Central and Northern California Coastal Zone and Offshore Areas. Winzler and Kelley, Eureka. BLM Contract No. AA550-CT6-52.

Rodrigue, R.F., G.J. Bakus, W.N. Jesse, and J.F. Lamorte. 1976. "A 12-month Investigation of the Intertidal Biology at Ocean Beach and the Point Arguello Boathouse". Tetra Tech Report for SAMSO: 196 p.

Roesijadi, G. and J.W. Anderson. 1979. Condition Index and Free Amino Acid Content of Macoma inquinata Exposed to Oil-Contaminated Marine Sediments. In: (W.B. Vernberg, A. Calabrese, F. Thurberg, and F.J. Vernberg eds.). Marine Pollution: Functional Responses, New York, NY, Academic Press.

Rose, C.D. and T.J. Ward. 1981. Acute Toxicity and Aquatic Hazard Associated With Discharged Formation Water. In: Environmental Effects of Offshore Oil Production. The Buccaneer Gas and Oil Field Study. Middleditch, B.J. (ed.), Plenum Press, New York, NY, 446 p.

Ross, D.C. 1978. The Salinian Block - A Mesozoic Granitic Orphan in the California Coast Range. In: Howell, D.G., and McDougal, K.A., eds., Mesozoic Paleography of the Western United States. Society of Economic Paleontologists and Mineralogists, Pacific Section. Pacific Coast Paleogeography Symposium 2, pp. 509-522.

Ross, D.C. and D.S. McCulloch. 1979. Cross Section of the Southern Coast Ranges and San Joaquin Valley from Offshore Point Sur to Madera, California. Geological Society of America Map and Chart Series MC-28H, 4 p.

Royal Commission on Environmental Pollution, 8th Report on Oil Pollution at Sea. 1981. Kornberg, Sir Hans, Chairman. Her Majesty's Stationary Office, London, 307 p.

Rulifson, R.L. and R.W. Schoning. 1963. Geophysical Offshore Oil Explorations and Associated Fishery Problems. Investigational Report No. 1. Fish Commission of Oregon, Portland, OR, 46 p.

Rusnak, G.A. 1966. The Continental Margin of Northern and Central California. In: Bailey, E.H. ed., Geology of Northern California. California Division of Mines and Geology bull. 190, pp. 325-335.

Samuels, W.B., N.E. Hueng, and D.E. Armstatz. 1982. An Oil Spill Trajectory Analysis Model with a Variable Wind Deflection Angle. Ocean Engineering.

Sanborn, H.R. and D.C. Malins. 1977. Toxicity and Metabolism of Naphthalene: A Study with Marine Larval Invertebrates. Proc. Soc. Exper. Biol. Med. 154: 151-155.

San Luis Obispo, County of. 1979. Industrial and Energy-Related Facilities and other Coastal-Dependent Industry, Planning Department.

San Mateo, County of. 1972. Land Use Plan, Local Coastal Plan, Hearing Draft Department of Environmental Management, Planning and Development Division.

Santa Barbara, County of. 1979. Coastal Plan, Hearing Draft, Planning Department.

Santa Cruz, County of. 1981. Local Coastal Program, Land Use Plan, Public Hearing Draft, Planning Department.

Schizas, K. 1982. Personal Communication, Planner, County of Santa Barbara.

Schwartzlose, R.A. 1963. Nearshore Currents of the Western United States amd Baja as Measured by Drift Bottles. CalCOFI 9:15-22.

Schwartzlose, R.A. and J.L. Reid. 1972. Nearshore Circulation in the California Current. CalCOFI 16:57-65.

Shenton, E. 1973. An Historical Review of Oil Spills Along the Maine Coast (draft copy).

Silver, E.A. 1971. Transitional Tectonics and Late Cenozoic Structure of the Continental Margin off Northernmost Califonria. Geological Society of America bull. vol. 82 no. 1, pp. 1-22.

Simpson, R.A. 1977. The Biology of Two Offshore Oil Platforms. IMR Reference 76-13, Institute of Marine Resources, University of California, La Jolla, CA 14 p.

Smith, G.M. 1969. Marine Algae of the Monterey Peninsula California. Second Edition Standford Univ. Press. Stanford, 752 p.

Smith, R.A., and J.R. Slack, T. Wyant, and K.J. Lanfear. 1982. The Oilspill Risk Analysis Model of the U.S. Geological Survey. U.S. Geological Survey Professional Paper No. 1227. 40 p.

Smith, R.L. and J.A. Cameron. 1979. Effect of Water Soluble Fraction of Prudhoe Bay Crude Oil on Embryonic Development of Pacific herring. Trans. Amer. Fish. Soc. 108:70-75.

Smith, S.W. 1975. Ground Motion Analysis for the Humboldt Bay Nuclear Power Plant. Unpublished Report to Pacific Gas and Electric Company, San Francisco, CA.

Smith, T.G. and J.R. Geraci. 1975. The Effect of Contact and Ingestion of Crude Oil on Ringed Seals of the Beaufort Sea. Beaufort Sea Project Tech. Rept. 5.

Sonoma, County of. 1981. Coastal Plan, Sonoma County Department of Planning.

Sowls, A.L., A.R. Degange, J.W. Nelson and G.S. Lester. 1980. Catalog of California Seabird Colonies. Coastal Ecosystems Project, Office of Biological Services, Fish and Wildlife Services, Washington, D.C. 371 p.

Spies, R.B., P.H. Davis, and D.H. Stuermer. 1980. Ecology of a Submarine Petroleum Seep off the California Coast, pp. 229-63. In: Marine Environmental Pollution, 1. Hyrocarbons. [Ed.] R.A. Geyer. Elsevies Sci. Publ. Co. Amsterdam, Netherlands.

Spooner, M.F. 1978. Editorial Introduction. Amoco Cadiz Oil Spill. Mar. Pollut. bull. 9:281-284.

Squire, J.L. Observations on Cumulative Bottom Drift in Monterey Bay Using Seabed Drifters. Limnol. Oceangr., 14(1):163-167.

State Lands Commission. 1982. Finalizing Addendum Program Environmental Impact Report Leasing, Exploration and Development of Oil and Gas Resources on State Tide and Submerged Lands, Point Conception to Point Arguello, Santa Barbara County, California State of California - Chambers Consultant and Planners.

State of California Department of Finance. 1977. Population for California Counties 1975-2020 with Age/Sex Detail to 2000, Series E-150 (Report 77-P-3).

State of California Lands Commission. 1982. Draft Program Environmental Program Impact Report. Leasing, Exploration and Development of Resources on State Tide and Submerged Lands - Pt. Conception to Point Arguello, Santa Barbara County.

Stegeman, J.J. 1978. Influence of Environmental Contamination on Cytochrome P-450 Mixed Function Oxidoses in Fish: Implications for recovery in the Wild Harbor marsh. J. Fish. Res. Bd. Can. 35:668-674.

Stephenson, M.D., J.H. Martin, and M. Martin. 1978. State Mussel Watch--Trace Metal Concentrations in the California Mussel at Areas of Special Biological Significance (Draft Annual Report). State of California State Water Resources Control Board Interagency Agreement 56E400.

Stephenson, T. and A. Stephenson. 1972. Life Between Tidemarks on Rocky Shores. Freeman, San Francisco, CA, 425 p.

Straughan, D. 1971a. Biological and Oceanographical Survey of the Santa Barbara Channel Oil Spill 1969-70. vol. 1. Biology and Bacteriology. Allan Hancock Found. Univ. So. Calif. 426 p.

Struhsaker, J.W. 1977. Effects of Benzene (A Toxic Component of Petroleum) on Spawning Pacific Herring, Clupea harengus pallasi. Fish bull. (U.S.) 75:43-49.

Thomas, R.E. and S.D. Rice. 1981. Excretion of Aromatic Hydrocabons and their Metabolites by Freshwater and Seawater. Dolly Varden Char. In: Vernberg, J. A. Calabrese, F.P. Thurberg, and W.B. Vernberg (eds.). Biological Monitoring. of Marine Pollutants. Academic Press, New York, NY.

Thompson, J.H. and T.J. Bright. 1980. Effects of an Offshore Drilling Fluid on Selected Corals. In: Proc. Symp. Res. Environmental Fate and Effects of Drilling Fluids and Cuttings. Jan. 21-24, 1980, Lake Buena Vista, FL. Courtesy Assoc., Washington, D.C.

Thomas, W.H. and D.L.R. Seibert. 1974. Distribution of Nitrate, Phosphate, and Silicate in the California Current Region, 1969. CalCOFI Atlas No. 20.

Tisot, J. and B. Gerard. 1981. Analysis of Physical and Mechanical Properties of Deepsea Sediments from Potential Manganese Nodule Mining Areas in the North Central Pacific. Offshore Technology Conference Proceedings Paper OTC 4132, pp. 139-142.

Trask, T. 1971. A Study of Three Sandy Beaches in the Santa Barbara, CA area. In: Biological and Oceanographical Survey of the Santa Barbara Channel Oil Spill 1969-70. Pub. Allan Hancock Foundation 1:159-178.

Tuck, L.M. 1960. The Murres. Can. Wildlife Service, Ottawa.

University of Oklamoma. 1975. Energy Alternatives. A Comparative Analysis. Office of Science and Public Polity Program.

U.S. Department of the Air Force. 1982. Environmental Impact Analysis Process. Draft Supplement to Final Final Environmental Impact Statement Space Shuttle Program Vandenberg AFB, CA.

U.S. Department of Commerce. 1977. Industry-Specific Gross Output Multiples for BEA Economic Areas.

U.S. Department of Commerce. 1981a. Santa Barbara Channel Risk Management Program. Prepared for the California Coastal Commission by the National Maritime Research Center, Kings Point, NY.

U.S. Department of Commerce. 1981b. Fisheries of the United States, 1980. Current Fishery Statistics No. 8100. NOAA, NMFS, Washington, D.C., 132 p.

U.S. Department of Commerce. 1981c. Bureau of the Census. Selected Housing Characteristics by States and Countries: 1980. 1980 Census of Housing Supplementary Reports, HC80-S1-1.

U.S. Department of Energy. Energy Information Administration. 1977. Annual Report to Congress vol. II, Projections of Energy Supply and Demand and Their Impacts.

U.S. Department of the Interior. 1978. POCS Reference Paper No. II, Description of the Coastal Environment from Pt. Reyes to Punta Eugenia, for

OCS Sale No. 48. Bureau of Land Management, Pacific OCS Office, Los Angeles, CA, 1436 p.

U.S. Environmental Protection Agency. 1974. Brine Disposal Treatment Practices Relating to the Oil Production Industry. Prepared by: Reid, G.W., Streehin, L.E., Contro, L.W.; and Smith, J.R. U.S. Environmental Protection Agency, Washington, D.C.: EPA-660/2-74-034.

U.S. Environmental Protection Agency. 1976. Quality Criteria for Water. U.S. Environmental Protection Agency, Washington, D.C., 256 p.

U.S. Environmental Protection Agency. 1980. Environmental Outlook 1980. Office of Research and Development, Washington, D.C.

U.S. Geological Survey. 1966. Mineral and Water Resources of California Part I Mineral Resources Report U.S. Government Printing Office, Washington, D.C.

U.S. Geological Survey. 1981a. Compilation of Regulations Related to Mineral Resource Activities on the Outer Continental Shelf.

U.S. Geological Survey. 1981b. Estimates of Undiscovered Recoverable Resources of Conventionally Producible Oil and Gas in the United States, 17 p.

U.S. Naval Weather Service Detachment. 1976. In: A Summary of Knowledge of the Central and Northern California Coastal Zone and Offshore Areas. Prepared by Winzler and Kelly Consulting Engineers. Under Contract No. AA550-CT6-52 with U.S. Department of the Interior, BLM. Eureka, CA, vol. 1. (Available NTIS, Springfield, VA).

U.S. Oceanic and Atmospheric Administration, 1982. Cordell Banks Resource Summary and Site Description. Sanctuary Programs Office. Washington, D.C.

Valentine, J.W. 1966. Numerical Analysis of Marine Molluskan Ranges on the Extratropical Northeastern Pacific Shelf. Limnol. Oceangr. 11:198-211.

Vanderhorst, J.R. etal. 1981. Recovery of Strait of Juan deFuca Intertidal Habitats Following Experimental Contamination with Oil. Marine Ecosystems Analysis Program, Boulder, Colorado. Final Report.

Vandermeulen, J.H. 1977. The Chedabucto Bay Spill-Arrow, 1970. Oceanus 20(4): pp.31-39.

Varanasi, U., and D.J. Fmur. 1980. Metabolic Activation and Coualent Bonding of Benzo (alpyrene to Deoxyribonucleic Acid Catalyzed by Liver Enzymes of Marine Fish. Biochem. Pharmacol. 29:753-761.

Varanasi, U. et al. 1981. Effect of Environmental Temperature on Naphthalene Metabolism by Juvenile Starry Flounder (Platichthys stellatus). Arch. Environ. Contam. Toxicol. 10:203-214.

Vargo, S.L. 1981. The Effects of Chronic Low Concentrations of No. 2 Fuel Oil on the Physiology of a Temperature Estuarine Zooplankton Community in the MERL microcosms. In: Biological Monitoring of Marine Pollutants. (Vernberg, F.J., Calabrese, A., Thurberg, F.P., and Vernberg, W.D. eds.) Academic Press, New York, NY.

Vesco, L.L. and Gillard, R.M. 1980. Recovery of Benthic Marine Populations along the Pacific Coast of the United States following Natural and Man-made Disturbances including Pertinent Life History Information, POCS Reference Paper No. 53-4. Pacific Outer Continental Shelf Office, Bureau of Land Management, U.S. Department of the Interior. 50 p.

Vuorinen, P. and M.B. Axell. 1980. Effects of the Water Soluble Fraction of Crude Oil on Herring Eggs and Pike Fry. I.C.E.S., C.M. 1980/E:30, 10 p.

Wagner, H.C. 1974. Marine Geology between Cape San Martin and Point Sal, South Central California Offshore. A Preliminary Report. U.S. Geological Survey Open-File Report 74-252 17 p., 4 maps.

Walker, J.D. and R.R. Colwell. 1976. Measuring the Potential Activity of Hydrocarbon Degrading Bacteria. Appl. Environ. Microbiol. 31:189-197.

Warner, R.F. 1969. Experimental Effects of Oil Pollution in Canada. An evaluation of Problems and Research Needs. Can. Wild. Serv. MS Rep.-No. 645.

Weinhold, R.J. and R.R. Weaver. 1973. Seismic Air Guns Effect on Immature Coho Salmon. Soc. Expl. Geophys. Unpubl., 13 p.

Welday, E.E. and J.W. Williams. 1975. Offshore Surfical Geologic Map of California. California Division of Mines and Geology, Mapsheet 26.

Wells, P.G. and Sprague, J.B. 1976. Effects of Crude Oil on American Lobster (Homarus americanus) Larvae in the Laboratory. J. Fish. Res. Bd. Can. 33:1604-1624.

White, D.H. et al. 1979. Effects of No. 2 Fuel Oil on Hatchability of Marine and Estuarine Bird Eggs. Bull. Env. Contam. Toxicol. 21:7-10.

Wickham, J.B. 1975. Observations of the California Countercurrent. J. Mar. Res. 33(3): pp. 325-340.

Wiegel, R.C. 1970. Earthquake Engineering. Englewood Cliff, N.J. Prentice-Hall, Inc., 518 p.

Wiens, J.A., G. Ford, D. Heinemann, C. Fieber, 1978. Simulation Modeling of Marine Bird Population Energites, Food Consumption, and Sensitivity to Perturbation. Annual Report RU#108, Oregon State University, Corvalis, OR, 136 p.

Wild, P.W. and J.S. Ams. 1974. A Report on the Sea Otter, Enhydra lutris L., in California. Calif. Dept. of Fish and Game, Mar. Res. Tech. Rept. 20:1-93.

Williams, R. et. al. 1980. Climatology and Oceanographic Analysis of the California Pacific OCS. Prepared for BLM under Contract No. AA551-IA9-2 by the Environmental Data and Information Service, NOAA.

Williams, R.G., R.W. Reeves, F.A. Godshall, S.W. Fehler, G.R. Halliwell, K.C. Vierra, C.N.K. Mooers, M.D. Earle, and K. Bush. 1981. A Climatology and Oceanographic Analysis of the California Pacific Outer Continental Shelf Region. U.S. Department of Commerce, NTIS PB 82192220.

Wilson, T.A. and J.L. Mero. 1966. Economic Deposits of the California Offshore Area. In: Bailey, E.H., ed. Geology of Northern California, California Division of Mines and Geology bull. 190, pp. 343-353.

Winters, K. et al. 1977. Water Soluble Extractions from Petroleum Oils: Chemical Characterization and Effects on Microalgae and Marine Animals. Rapp. P-V Reun Cons. Int. Explor. Mer. 171:166-174.

Winzler & Kelley, Consulting Engineers. 1977. A Summary of Knowledge of the Central and Northern California Coastal Zone and Offshore Areas. Eureka, CA. Vols. I-IV. Prepared for the Bureau of Land Management, U.S. Department of the Interior, Contract No. AA550-CT6-52.

Wolfe, D.A. (ed.). 1977. Fate and Effects of Petroleum Hydrocarbon in Marine Organizims and Ecosystems. Pergamon Press, New York, NY, 478 p.

Woodhouse, C., R. Cowan, and L. Wilcoxon. 1977. A Summary of Knowledge of the Sea Otter, Enhydra lutris L., in California and an Appraisal of the Completeness of the Biological Understanding of the Species (Publication 270 374, National Technical Information Service, Springfield, VA).

Woodward-Clyde Consultants (1982). Central and Northern California Coastal Marine Habitats: Oil Residence and a Biological Sensitivity Indices.

Wyllie, J.G. 1966. Geostrophic Flow of the California Current at the Surface and at 200 Meters. Calif. Coop. Oceanic Fish. Invest. Atlas 4, 288 p.

Wyllie, J.G. and R.J. Lynn. 1971. Distribution of Temperature and Salinity of 10 Meters, 1960-69 and Mean Temperatures, Salinity and Oxygen at 150 Meters, 1950-68 in the California Current. Mar. Res. Comm. CalCOFI Atlas No. 15.

Yamasaki, R.M. 1982. POCS' Technical Paper No. 82-4. Conceptual Oil and Gas Transportation Scenarios of Proposed OCS Sale No. 73 Offshore Central and Northern California. Minerals Management Service, Pacific OCS Regional Office, Los Angeles, CA, 22 p.

Youd, T.L. and S.N. Hoose. 1978. Historic Ground Failures in Northern California Triggered by Earthquakes. U.S. Geological Survey Professional Paper 993, 177 p.

Young, P.H. 1969. The California Partyboat Fishery. California Department of Fish and Game, Fish. bull. 145, p. 91.

Zein-Eldin, A.P. and P.M. Keney. 1978. Environmental Assessment of an Active Oil Field in the Northwestern Gulf of Mexico Bioassays of Buccaneer Oil Field Effluents with Juvenile and Adult Penaeid Shrimp. Proj. Rept. for National Marine Fisheries Service, Galveston, TX.

VII. PRINCIPAL PREPARERS AND SUPPORT STAFF - PACIFIC OCS OFFICE

John C. Lane..........................Chief, Environmental Leasing Section
Debra Agnolet.........................Sale No. 73 Project Leader: Geologist
George Hampton........................Environmental Specialist
Mertis Harding-Baffoe.................Land Law Examiner
Boyd Bosserman........................Cartographic Technician
Cheryl S. Conel.......................Biologist
Jose M. Fernandez.....................Economist
Robert M. Gillard, Ph.D...............Biological Oceanographer
Beatrice Gordoa.......................Secretary, Environmental Leasing Section
Joanne MacGregor-Hanifan..............Community Planner
Dirk C. Herkhof.......................Meteorologist
Maurice L. Hill.......................Physical Scientist
Robert Karpas.........................Physical Scientist
Elaine Lewis..........................Secretary, Environmental Leasing Section
Irving A. Marcus......................Editor
Al Mack...............................Visual Information Specialist
Jim Mauck.............................Cartographic Technician
Fred M. Piltz, Ph.D...................Oceanographer
Lynnette L. Vesco.....................Fishery Biologist
Alexander C. Watt.....................Geographer
Frederick L. White....................Economist
Robert M. Yamasaki....................Environmental Engineer

INDEX

VIII.

VIII. INDEX

APPENDICES

IX.

CHAPTER IX

IX. APPENDICES

A. Definitions of Level of Expected Impact

The following definitions are employed in this EIS to describe the level of impacts expected to occur to each individual resource category as a result of Proposed Sale No. 73.

Water Quality

VERY HIGH - Water quality parameters (eg. BOD, COD, salinity, temperature, etc.) change a few to many orders of magnitude, toxic trace metals or hydrocarbons exceed EPA safe levels, changes persist for months or longer.

HIGH - Water quality parameters change by several orders of magnitude, most or all toxic trace metals or hydrocarbons are near EPA safe levels, changes persist for days to weeks.

MODERATE - Statistically significant changes in water quality parameters (perhaps by factors of 2 or 3 orders of magnitude), toxic trace metals or hydrocarbons elevated for some metals or hydrocarbons, changes may persist for days to weeks.

LOW - A few water quality parameters toxic trace metals, or hydrocarbons elevated above normal ambient levels, changes quickly (within 1-2 days) to weeks.

VERY LOW - Water quality parameters, toxic trace metals, and hydrocarbons show no stable statistically significant changes from ambient conditions except within a few meters of the source of the pollutant.

Ocean Dumping

VERY HIGH - Operations would disturb an existing dump site resulting in contamination of the water column over a large area, or operations would prohibit use of the area as a dumpsite.

HIGH - Operations would disturb an existing dump site possibly resulting in contamination of the water column over a large area, or operations possibly would prohibit use of the area as a dump site.

MODERATE - Operations may disturb an existing dump site resulting in contamination of the local water columns or operations may have some conflicts with use of the areas as a dump site.

LOW - Operations may disturb an existing dump site resulting in contamination of the local water column, or operations may have some conflicts with use of the areas as a dump site.

VERY LOW - Boundary lines might overlap but operations will not disturb any existing dump sites, or operations will have no conflicts with use of the area as a dump site.

Air Quality

VERY HIGH - Significant increase in pollutant concentrations within a non-attainment area occurring more than 10 days per year. Pollutant concentrations in attainment areas increasing to levels equivalent to the ambient air quality standards. Large emission controls and/or offset costs likely.

HIGH - Significant increase in pollutant concentrations within a nonattainment area occurring between 3 and 10 days per year. Pollutant concentrations in attainment areas increasing to levels close to the ambient air quality standards. Large emission controls and/or offset costs likely.

MODERATE - Significant increase in pollutant concentrations within a non-attainment area occurring about 2 or 3 days per year. Moderate increase in pollutant concentrations within an attainment area. Moderate emission controls and/or offset costs likely.

LOW - Insignificant increase in pollutant concentrations within a nonattainment area. Significant increase in pollutant concentrations in an attainment area. Normal emission control strategies likely.

VERY LOW - No change in air pollutant concentrations within a nonattainment area; insignificant increase in pollutant concentrations in an attainment area.

Fish

VERY HIGH - Major reductions in the population sizes of many species.

HIGH - Major reductions in the population sizes of a few species.

MODERATE - Moderate or high reductions in the population sizes of a few species.

LOW - A small reduction in the population sizes of a few species. Not measurable against natural variation in fish populations.

VERY LOW - Sublethal and lethal changes insignificant.

Coastal Ecosystems[a]

VERY HIGH - A species or assemblage will become threatened or endangered.

HIGH - A significant long-term[b] interference with ecological relationships lasting at least two years. This usually involves the mortality or a

---

[a] Includes impact levels for Intertidal Benthos, Subtidal Benthos, Estuaries and Wetlands; and estuaries, intertidal and benthic portions of Areas of Special Concern, and Pt. Reyes/Marine Sanctuaries.

biological alteration of a noticeable segment of the population, community or assemblage.

MODERATE - A significant interference with ecological relationships lasting less than two years.

LOW - An interference with ecological relationships lasting less than a year that is not significant to either the relationships, species, community or assemblage.

VERY LOW - Loss of a few individuals but no interference with ecological relationships.

Endangered and Threatened Species, Marine Mammals and Seabirds

The impact levels for endangered species, marine mammals and seabirds are guidelines or estimates of the severity of an event. Where indicated in Chapter IV, they are backed by specific analysis or assumptions. In other instances they are merely best estimate by the resource specialist.

The impact levels for endangered and threatened species are elevated one level from those stated below due to the sensitive nature of the populations.

VERY HIGH - A major reduction in the California population requiring decades for recovery. In some circumstances, recovery may never occur. A very high impact is the level that would be expected to occur every 100 years due to natural evironmental events.

HIGH - Moderate to major reduction in the size of the California population requiring several years to decades for recovery. A high impact is the level would be expected to occur every 30-40 years due to natural environmental conditions.

MODERATE - Moderate reduction in the California population requiring several years for recovery. A moderate impact is the level that would be expected to occur once a decade due to natural environmental conditions.

LOW - Small or moderate reduction in the California population requiring several months to a few years for recovery. A low impact is the level that would be expected to occur every few years due to natural environmental conditions.

VERY LOW - Short-term impacts, not necessarily discernible at the population level but may include some mortality. If impacts are longer-term or chronic, they are minor, not measurable and do not significantly reduce the health of the populations even though the effects may extend for the life of the proposal. A very low impact is the level that would be expected to occur annually due to natural environmental events. All actions are assumed to have at least a very low impact unless so stated. Very low impacts are considered insignificant.

---

[b] The definition of "long-term" in reality is variable in terms of a specific number of years. If a generation of a particular species is eliminated from an

Coastal Economy

VERY HIGH - A change in employment and/or earnings of 10 percent or greater.

HIGH - A change in employment and/or earnings of 7 to 9 percent.

MODERATE - A change in employment and/or earnings of 4 to 6 percent.

LOW - A change in employment and/or earnings of 1 to 3 percent.

VERY LOW - A change in employment and/or earnings of less than 1 percent.

Demography

VERY HIGH - Potentially significant long-term stress on public and private services and facilities; an increase of greater than 20 percent of the baseline population of the affected area.

HIGH - Potentially significant short-term and minor long-term stress on public and private services and facilities; an increase of 10 to 20 percent of the baseline population of the affected area.

MODERATE - Moderate short-term stress on public and private services and facilities; an increase of 5 to 10 percent of the baseline population of the affected area.

LOW - Minor short-term stress on public and private services and facilities; an increase of 1 to 5 percent of the baseline population of the affected area.

VERY LOW - No significant stress on public and private services and facilities; an increase of less than one percent of the baseline population of the affected area.

Public Services and Facilities

VERY HIGH - Potentially significant long-term stress on public services and facilities; regional water supply substantially affected requiring facility construction, facility expansion or a new source of water. New or major expansion rquired for wastewater treatment, significant disruption of existing transportation patterns or power supply.

HIGH - Potentially significant short-term and minor long-term stress on public services and facilities; water supply and wastewater treatment facility in several areas substantially affected requiring modification of existing facilities; short-term and some long-term disruption of transportation patterns; power supply grid stressed.

---

area and it requires several generations to build the population to its original level, then this should be considered a long-term impact. However, since the reproductive periods of the various species varies from weeks in certain invertebrates to many years in other organisms, a long-term impact will, in reality, last several months to many years. Long-term impacts, as used here will be considered to be at least two years.

MODERATE - Moderate short-term stress on public services and facilities; water supply or wastewater treatment facilities in one area noticeably affected stressing existing facilities; moderate short-term disruption of transportation pattern; power supply grid moderately stressed.

LOW - Minor short-term stress on public services and facilities; water supply or wastewater treatment facilities slightly stressed; minor inconveniences in transportation pattern; power supply slightly stressed.

VERY LOW - No significant stress on public services and facilities; no noticeable affect on water supply, wastewater treatment facilities; transportation patterns or power supply.

Coastal Land Use

VERY HIGH - Industrial and other uses such as recreation, housing, etc. are completely incompatible (e.g. a support base in a recreation area); land use plans prohibit OCS related land use.

HIGH - Highly incompatible use between industrial and other uses such as recreation, housing, etc., or sitings in a residential, urban or natural area which results in impacts or fuisance, noise, traffic; little or no mitigation (buffer zone, distance or proximity) or sitings where no land use plans are in place.

MODERATE - Moderate incompatibility which may be caused by siting requests that result in changes to existing land use plans and which still allow a lesser degree of the above impacts; or sitings occur in rural or natural areas adjacent to other developments (e.g. a support base near a farm site).

LOW - Low incompatibility because impacts are obviated or mitigated by land use plans, CZM plans, and Federal, State, and local regulations and permitting procedures which already exist. It is assumed that sitings must meet specifications before permits are granted.

VERY LOW - No incompatibility because sitings would easily meet specifications or requirements, if any are required.

Commercial Fisheries

VERY HIGH - A 30 percent or greater economic loss to the commercial fishing industry. Many fishermen out of work and secondary employment (fish processing plants, etc.) substantially affected.

HIGH - A 20-30 percent economic loss to the commercial fishing industry. Several fishermen out of work and secondary employment affected.

MODERATE - A 10-20 percent economic loss to the industry. A few fishermen out of work, and some financial loss to other fishermen and secondary employment.

LOW - Less than a 10 percent economic loss to the industry. A few fishermen affected but no effect on secondary employment expected. Not measurable against losses due to natural variation in commercial fish harvests.

VERY LOW - Economic loss insignificant.

Sportfishing

VERY HIGH - A 30 percent or greater economic loss to the industry. All fishing stopped for any length of time, or partial closure for an extended period of time.

HIGH - A 10 percent or greater economic loss to the industry. Most sport-fishing stopped.

MODERATE - Less than 10 percent economic loss to the industry. Most sport-fishing still possible.

LOW - A small economic loss to the industry. Most fishing continues.

VERY LOW - Economic loss insignificant. A few fishermen affected by minor inconveniences, if any.

Recreation

VERY HIGH - Complete closure of all water-oriented recreation facilities for any length of time, or partial closure for an extended period of time; or a 25 percent or greater economic loss to industry.

HIGH - Closure of most water-oriented recreational facilities; some beach and water use possible; or a 15 percent or greater economic loss to the industry.

MODERATE - Partial closure of some water-oriented recreational facilities; most beach and water use still possible; or a 5 percent or greater economic loss to the industry.

LOW - No closure of water-oriented recreational facilities; most beach and water use still possible; or less than a 5 percent or greater loss to the industry.

VERY LOW - No closure of water-oriented recreational facilities; all beach and water use occuring with minor inconveniences, if any.

Tourism

VERY HIGH - Complete shutdown of tourist industry for any length of time, or partial shutdown for an extended period of time.

HIGH - Shutdown of most tourist related industries; some tourism still occurs.

MODERATE - Partial shutdown of some tourist facilities; most tourism still occurs.

LOW - No shutdown of tourist facilities; most tourism still occurs.

VERY LOW - No shutdown of tourist facilities; no drop in tourism; minor inconveniences, if any.

Visual Resources

VERY HIGH - Visual quality degraded to an extent that it affects all people in the area; reduced recreational visitation to the area; reduced property values.

HIGH - Visual quality degraded to an extent which affects most people in the area; reduced recreational use of the area; reduction in property values likely.

MODERATE - Visual quality degraded to an extent which affects about half the people in the area; no noticeable reduction in recreational use; no perceptible reduction in property values.

LOW - Minor degradation in visual quality; most people accept the change; no reduction in recreational use or property values.

VERY LOW - No significant reduction in visual quality; or few people notice changes. No reduction in recreational use of property values.

Cultural Resources

VERY HIGH - Many cultural resources are expected to be present and disturbed.

HIGH - A few cultural resources are expected to be present and disturbed.

MODERATE - Significant possibility of both presence and disturbance of cultural resources.

LOW - Remote possibility of presence and disturbance of cultural resources.

VERY LOW - No cultural resources likely to be present or disturbed.

Ports and Harbors

VERY HIGH - New ports or harbors would be required.

HIGH - Additional docks, berths, and facilities would be required.

MODERATE - Some new facilities would be required but major expansion or renovation not necessary.

LOW - Minor expansion of existing facilities would be required.

VERY LOW - Little or no expansion of existing facilities would be required.

Marine Traffic

VERY HIGH - Vessel conflicts occur frequently. Re-routing of all shipping traffic, or creation of a new routing system would be necessary.

HIGH - Vessel conflicts occur frequently. Re-routing of some shipping traffic would be necessary.

MODERATE - Vessel conflicts occur frequently. Re-routing of shipping traffic not necessary.

LOW - Vessel conflicts occur, but are minor in character and infrequent.

VERY LOW - Vessel conflicts rarely, if ever, occur and when they occur, conflicts are always minor.

Refineries

VERY HIGH - New refineries would be reuqired to process produced oil.

HIGH - Requirement for expensive modifications to the refinery process to handle heavy, high sulphur crude oil.

MODERATE - Major contribution to the requirement for expensive modifications to the refinery process.

LOW - Minor contribution to the requirement for expensive modifications to the refinery process.

VERY LOW - Requirement for minor modifications to the refinery process.

Offshore Structures

VERY HIGH - Affected structures would have to be completely replaced. Down time would exceed one month.

HIGH - Affected structures could be repaired with some replacement. These activities would result in over one week of down time.

MODERATE - Affected structures could be repaired with some replacement. These activities would result in down time of a few days to one week.

LOW - Affected structures could be repaired, with little, if any, replacement. Down time would be only one or two days.

VERY LOW - Affected structures could be repaired in a short time.

Military Uses

VERY HIGH - Exclusive-use area would have to be completely shifted, curtailed, or eliminated. Extensive alterations or reductions to military operations would be required.

HIGH - Exclusive-use areas would have to be shifted or reduced slightly. Significant alterations or reductions to military operations would be required.

MODERATE - Exclusive-use areas would have to be shifted or reduced slightly. Minor alterations or reductions to military operations would be required.

HIGH - Exclusive-use areas would have to be shifted or reduced slightly. Significant alterations or reductions to military operations would be required.

MODERATE - Exclusive-use areas would have to be shifted or reduced slightly. Minor alterations or reductions to military operations would be required.

LOW - Exclusive-use areas would have minimal overlap with resource development areas. Almost no alterations or reductions to military operations would be required.

VERY LOW - No alterations or reductions of military operations would be required.

B. List of Tracts Deleted From Previous Sales

The Tracts listed below were deferred or deleted from previous sales in Central and Northern California. The reason for their deletion or deferral is also listed.

1963 Sale. The following tracts were requested by the Department of Defense during tentative tract selection to be deleted from the 1963 Sale due to military concerns:

Eureka Area (South Half) Map No. 1S*

33N-44W	33N-44W	
32N-44W	32N-42W	
34N-43W	36N-41W	
33N-43W	35N-41W	(per official maps)
32N-43W	34N-41W	
36N-42W	33N-41W	
35N-42W	36N-40W	
34N-42W	35N-40W	

The following tracts located off Vandenberg Air Force Base were requested by the Department of Defense during final tract selection to be deleted from the 1963 Sale due to military concerns:

Morro Bay Area Map No. 5*

35N-55W	30N-54W
34N-55W	29N-43W
33N-55W	33N-53W
32N-55W	32N-53W
31N-55W	31N-42W
30N-55W	30N-53W
35N-54W	29N-53W
34N-54W	34N-52W
33N-54W	31N-52W
32N-54W	30N-52W
31N-54W	24N-50W

*The blocks for the 1963 Sale were based on the California (Lambert) Plane Coordinate System. However, Sale No. 53, Sale No. 73, and RS-2 blocks are of the Universal Transverse Mercator Grid System based upon the Clark Spheroid of 1866.

Sale No. 53. The following tracts were deferred by Secretary Watt until "a decision on the legal status in California with respect to whether the lease sale itself directly affects the coastal zone and, thus, requires the Department to make a determination of consistency with California's Coastal Zone Management program" (DOI Press Release, August 7, 1981).

Eel River Basin
Tracts 001-030

Point Arena Basin
Tracts 031-060

Bodega Basin
Tracts 061-068

Santa Cruz Basin
Tracts 069-128

C. Memorandum of Understanding Between MMS and the U.S. Coast Guard on Oil Spill Contingency Plan Guidelines

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U. S. Coast Guard (G-WER-2)
Washington, DC 20593
Phone: (202) 426-9568

COMDTNOTE 5740

15 APR 1982

COMMANDANT NOTICE 5740

CANCELLED: 15 OCT 1982

Subj: Memorandum of Understanding between the U. S. Geological Survey and the U. S. Coast Guard Concerning Regulation of Activities and Facilities on the U. S. Outer Continental Shelf

Ref: (a) Federal Register, Vol. 46, No. 5, Thursday, Jan 8, 1981, page 2199

1. PURPOSE. This notice provides amplifying information and revised guidelines to be used by On-Scene Coordinators in the review of oil spill contingency plans submitted to the Minerals Management Service (MMS) as part of OCS Exploration Plans, or Development and Production Plans. The guidelines established in COMDTNOTE 5740 of 14 May 1981 are superceded effective 1 June 1982.

2. DISCUSSION.

a. The U. S. Geological Survey (USGS) and the USCG signed subject MOU to promote the safety of activities and facilities on the OCS. The text of the MOU was published in reference (a). The MOU affects activities associated with the exploration, development, and production of mineral resources on the OCS, and is intended to avoid duplication of effort, and to promote consistent, coordinated, and less burdensome regulation of these facilities. In a recent Department of Interior internal reorganization, responsibility for OCS activities was transferred from USGS to the newly created Minerals Management Service. This organizational name change does not otherwise effect the MOU.

DISTRIBUTION - SDL No. 115

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
A																										
B		4	10		12									5												
C					5		2		1																	
D		5			1																					
E		1												1	5											
F																										
G																										
H																										

NON-STANDARD DISTRIBUTION:

2.b. Paragraph VII of the MOU gives the CG the responsibility to review the adequacy of the oil spill contingency plans submitted to the MMS as a part of the Exploration Plans or Development and Production Plans. The MOU further states that the criteria by which to judge the adequacy of the oil spill response organization, clean up equipment, and procedures will be jointly agreed upon by the MMS and the USCG. The On-Scene Coordinator for the zone in which the drilling activity will occur will conduct this review. Planning guidelines for conducting this review were initially developed for Lease Sale 42 on Georges Bank and later were promulgated for nationwide application in COMDTNOTE 5740 of 14 May 1981. While the guidelines have been implemented quite effectively for Lease Sale 42, it has become apparent that they do not allow sufficient flexibility to meet the diverse geographic differences and local conditions in other areas where drilling or production activity occur.

c. Revised guidelines for evaluating OCS oil spill contingency plans have been jointly agreed upon by MMS and USCG and are contained in enclosure (1). They are intended to provide general consistency in setting standards nationwide while allowing some flexibility to account for local conditions. The planning guidelines apply to OCS Exploration Plans or Development and Production Plans submitted for approval after 1 June 1982. Plans submitted and approved prior to that date are not affected by these guidelines except that operators at ongoing drilling/production operations shall ensure existing response equipment is upgraded to "state-of-the-art" as it is replaced.

d. A regional Technical Review Board (TRB) will assist OSCs in assessing the capabilities of open water equipment and in applying the general guidelines of enclosure (1) to his particular area. Specifically the TRB will:

(1) advise the OSC on whether response equipment proposed in the contingency plan meets currently accepted "state-of-the-art" criteria.

(2) advise the OSC on the adequacy of the amounts and types of equipment proposed.

(3) advise the OSC on acceptable response times for local conditions.

(4) keep abreast of developments in response equipment technology and revise state-of-the-art" criteria accordingly.

(5) provide OSCs with technical information on equipment proposed by operators.

2.e. Membership of the regional Technical Review Board is:

USCG District Commander representative - Co-chairman
MMS Deputy Minerals Manager Representative - Co-chairman
Appropriate USCG National Strike Force Commanding Officer
USEPA OHMSETT representative
USCG HQ DMT representative
USCG HQ WER representative
MMS HQ representative

3. ACTION.

a. District Commanders shall:

(1) Establish and maintain liaison with the appropriate Minerals Management official [see enclosure (2)] to ensure that oil spill contingency plans for the OCS are submitted for timely review.

(2) Establish a regional Technical Review Board as described above to assist OSCs in reviewing contingency plans.

b. On-Scene Coordinators shall consider the Planning Guidelines of enclosure (1) in evaluating Oil Spill Contingency Plans submitted in accordance with the MOU and advise MMS as to adequacy of the Plans.

c. Commandant will incorporate the provisions of this Notice in the Marine Safety Manual, CG-495.

W. E. Caldwell

W. E. CALDWELL
Chief, Office of Marine
Environment and Systems

Encl: (1) Planning Guidelines
(2) Addresses and phone numbers of MMS points of contact

Planning Guidelines

a. Risk Analysis: The contingency plan should contain an analysis which indicates the number and size of spills that could occur during OCS mineral exploration, development, and production operations. The spill trajectory analysis should indicate where an oil spill is likely to flow under the various expected sets of local, seasonal meteorological and oceanographic conditions. Impact areas should be identified and strategies should be fully developed for the protection of potentially vulnerable areas and resources. The depth of detail is flexible but should be sufficient to assure the OSC that adequate contingency planning has been done.

b. Recovery Equipment: The type of recovery equipment and its method of deployment rests entirely with the operator. However, subject to the prevalent conditions identified in the risk analysis, the equipment should be "state-of-the-art". Based on previous R&D studies, observations, and experiences, currently available "state-of-the-art" equipment is capable of operating in 8-10 foot seas and 20 knot winds with deployment accomplished in the 5-6 foot range. However, the OSC should be aware that mechanical equipment cannot be expected to perform at optimum efficiencies in all environmental situations. Local conditions such as high energy sea states with short wave lengths, or severe icing, may not allow all of the above operational criteria to be met.

c. Equipment Availability: The quantity and capability of the equipment to be made available should be related to the risk analysis. For planning purposes, open water recovery devices typically have a recovery capacity of at least 1000 barrels/day. A recovery rate of 1000 barrels/day should therefore be considered appropriate unless the risk analysis suggests a higher spill rate is likely. This recovery rate may be attained from one device or an array of devices which would be utilized in concert with each other. The contingency plan should also indicate how additional equipment will be made available for extraordinary spills, that is, spills that exceed the recovery capacity of the readily available equipment.

d. Response Time: If local conditions or geography permit, the target for initiating recovery operations with pre-staged equipment (i.e., the response time) should be six to twelve hours from the time of the spill dependent upon the location and general operating characteristics of the drilling or production activity. Whatever amount of equipment is required to be available for responding to spills should be fully deployed and in operation within the specified response time, weather permitting. The location of staged equipment will be left to the operator. For extraordinary spills, the operator should be expected to obtain additional equipment within 48 hours.

e. **Drills:** Response exercises for deploying equipment in open water shall occur at least annually to test the equipment and the contingency plan. This exercise should be held under realistic environmental conditions in which deployment and operation can be accomplished without endangering the safety of personnel. In addition, at least one hands-on drill should be conducted annually as part of a training program and may include full deployment conducted in protected waters. Exercises that test the alerting/initial response mechanism and command, control, and communications should be held as frequently as necessary to demonstrate effectiveness to the OSC.

f. Support Vessels: Vessels or vessel types to be used in deploying and operating the response equipment should be identified in the contingency plan. The vessels should be available within the same response time parameters as used for response equipment. The crews of all candidate support vessels should be familiar with equipment deployment and operating techniques; or a system should be developed to supply trained crews/supervisors to the support vessels within the specified response time.

g. Dispersant Equipment: In addition to oil recovery equipment, dispersant equipment should be included in the contingency plan. Equipment capable of applying dispersants should be maintained at appropriate staging points as well as adequate stockpiles of dispersants if they are not readily available from local distributors. The types and toxicities of dispersants proposed for use should be identified in the contingency plan. The quantity and types of dispersants presited should be related to the risk analysis, taking into account dispersant toxicity, oil composition and water temperature. The above should not be interpreted as a predilection on the part of government for the use of dispersants, but a recognition that spills may occur when, due to environmental conditions or lack of adequate support resources, mechanical recovery is not possible. The decision to use dispersants would of course be made using the criteria and procedures set forth in the National Oil and Hazardous Substances Pollution Contingency Plan. A response target of twenty-four hours from the time the spill occurs is appropriate, unless pre-approved contingency plans or a streamlined RRT authorization procedures for the use of dispersants are in effect. In this event, the response time may be lessened.

D. Oil Spill Cleanup Equipment Inventory

1. Clean Seas Equipment Inventory

Skimmers	Location	Performance Specifications
1 Cyclonet 100 skimmer system mounted on CS spill response vessel (Mr. Clean I)	Santa Barbara Harbor or Avila Beach	Can operate in moderate to heavy sea states (Mr. Clean I)
CS weir skimmer barge (45' x 17' x 6') with 2000-gpm pump and 200-bbl onboard O/W separation system and 2-240' sections of oil boom	Santa Barbara Harbor	Can operate in moderate sea states
2 Mark II weir skimmers	Carpinteria Yard	Works in waves up to 2-3 ft and winds up to 14-16 knots
1 Komara Mini-skimmer	Carpinteria Yard	Works in waves up to 2 ft
3 Floating weir skimmers	Carpinteria Yard	Works in waves up to 2-3 ft
1 Acme 39T skimmer	Santa Barbara Gaviota	Works in light seas
5 Acme 51T skimmers	Carpinteria Yard Morro Bay Ventura Point Dume	Works in light to moderate seas
1 Mark II-9 Oil Mop	Carpinteria Yard	Protected harbor
1 050 Cyclonet Skimmer with Zodiac work boat	Carpinteria Yard	Works in waves up to 3 ft
Containment Booms		
2000' of a 4' free-board and 8' draft heavy-duty bottom tension boom	Carpinteria Yard	Works in 6-8 ft waves, currents up to 1-1/4 knots and winds up to 25 knots

CLEAN SEAS (continued)

Containment Booms	Location	Performance Specifications
2 Vikoma Sea Packs, each 1600' long	Carpinteria Yard Morro Bay	Works in waves up to 6 ft and winds
2000 ft Kepner 16" x 12" curtain boom	Carpinteria Yard Gaviota	Works in waves up to 2 ft
2000 ft Kepner 8" x 12" curtain boom	Carpinteria Yard Santa Barbara	Harbor boom
4180 ft of inflatable Goodyear 12" x 24" Sea Sentry boom	Carpinteria Yard	Open ocean conditions
5527 ft of 12" x 17" Expandi boom	Point Dume Morro Bay Ventura	Works in moderate sea states
9100 ft of 43" Expandi heavy-duty sea boom	Morro Bay Ventura Santa Barbara	Works in waves up to 5 ft and winds up to 20 knots

Vessels		
Mr. Clean I 1 136' x 36' Dedicated Response Vessel fitted with Cyclonet 100 skimmers. Other equipment includes: 1 Vikoma Seapack 1500 ft of 43" Expandi Boom 2700 ft of 36" Goodyear Boom 1 Komara Skimmer 1 Dracone Storage Bag 1 Dispersant Spray Unit 1 15-ft Outboard Skiff 1 32-ft Boom Boat w/twin 175 hp Motors	Santa Barbara Harbor or Avila Beach	Open ocean conditions
Mr. Clean II 1 130' x 30' Dedicated Response Vessel equipped with the following: 2 ODI Center Section Skimming Barriers 4' x 65' 1 ODI 750 gpm Floating Pump System for above	Avila Beach	Open ocean conditions

CLEAN SEAS (continued)

Vessels	Location	Performance Specifications
Mr. Clean II cont. 1 Walosep W-3 Skimmer 2000 ft of 38" Goodyear Boom 1 Vikoma Seapack 1500 ft of 43" Expandi Boom 1 100-bbl Onboard Oil/Water Separation System 3 Kepner Storage Bags 1 32-ft Boom Boat w/twin 175 HP motors 1 Dispersant spray unit	Avila Beach	Open ocean conditions
1 19-ft Larson Skiff w/75 hp motor	Carpenteria Yard	Protected waters
3 14-ft Aluminum skiffs w/outboard motor	Carpenteria Ventura Avila Beach	Protected waters
1 21-ft Monark utility boat w/outboard motor	Carpenteria Yard	Calm to moderate seas
1 10-ft Avon rubber raft w/outboard motor	Carpenteria Yard	Protected waters
Dispersants and Application Equipment		
225 drums - Corexit 9572 dispersant	Carpenteria Yard	
2 Simplex Model 200 helicopter dispersant application systems	Carpenteria Yard	
1 Vessel mounted dispersant application system	Carpenteria Yard	
Oil Storage Equipment		
2 5000-gal. Kepner floating storage bags	Carpinteria Yard Gaviota	

CLEAN SEAS (continued)

Oil Storage Equipment	Location	Performance Specifications
6 1200-gal. Kepner floating storage bags	Ventura Carpinteria Yard Santa Barbara Point Dume Morro Bay	
1 6000-gal. Dracone floating storage bag	Carpenteria Yard	
Tide-Mar VII 7840 bbl tank barge	Ventura	
2 100-bbl oil/water recovery tanks	Carpinteria Yard	Use with CSI skimmer or elsewhere
4 100-bbl flat storage tanks	Carpinteria Yard	Use with all skimmer equipment

Other

6 40' enclosed trailer vans with booms, sorbents, and small skimmers	Carpinteria Yard Morro Bay Santa Barbara Ventura Gaviota Point Dume	
1 25' mobile communication center with radio base station, portable radios, and auxiliary power	Carpinteria Yard	
2 100 bbl. tank trailers - loaded with dispersants	Carpenteria Yard	
1 - 36' flatbed trailer	Carpenteria Yard	

Equipment Release Procedures

In the event of a spill that requires CS assistance, the spiller will call the CS Manager:

2. Clean Bay Equipment Inventory

Skimmers	Location
2 - Marco Class III M/V Spill Spoiler - 58' x 24' self-propelled skimmers capable of recovering all oils	1 - San Francisco 1 - Martinez Marina
2 - Marco Class I M/V Mini Spoiler - 34' x 10' self-propelled skimmers stored on trailers and capable of recovering all oils	1 - Long Wharf, Richmond 1 - Union Oil Co., Rodeo
2 - Exxon 77" diameter Open Seas Wier Skimmers used to recover contained oil	CB Warehouse
1 - OMI Oil Mop Mark I - 4E is used primarily in protected waters and will recover 4-8 bbls/hr	CB Warehouse
2 - PSI Oil Hawg Skimmers for use in relatively quiet waters and capable of up to 100 gpm pumping rate	CB Warehouse
2 - Skim Pak Skimmers for use in very calm waters with maximum pumping rate of 70 gpm	CB Warehouse
1 - Skim Inc. Skimmer	CB Warehouse
Containment Booms	
1 - Vikoma Seapack - 23' fast response boat containing 1600' of sea boom capable of performing in 6' waves and 20-25' winds	Diablo Hitch & Trailer
4600' - Kepner Sea Curtain 16" x 12" medium duty boom for ocean or harbor use	
2000' in 2 - 35' vans	IT Corporation
2600' in 2 - 40' vans	Diablo Hitch & Trailer

Containment Booms (cont.)	Location
6400' - American Marine Optimax 6" x 12" calm water harbor boom	Diablo Marina Martinez Marina
1640' - Whittaker Expandi Boom 12" x 18" fast deployment open ocean or harbor boom	CB Warehouse
500' - PPC Aquafence 6" x 18" calm water harbor boom	CB Warehouse

Boom Deployment & Work Boats	
2 - 34' Raider SRV Fast response or work vessel. Bow ramp - large load capacity with 2-175 HP motors each	1 - Union Oil Company Rodeo, CA 1 - Shell Oil Company Martinez, CA
1 - 16' Boston Whaler with 40 HP motor and trailer mounted	CB Warehouse
2 - 12' Pioneer Unsinkable Boats with outboard motors	CB Warehouse
2 - 10' John Boats, aluminum with outboard motors	CB Warehouse

Chemicals and Equipment	
1 - Helicopter spray unit for application of surface collecting agents	CB Warehouse
5 Drums - Shell Oil Herder	CB Warehouse
49 Drums - Exxon Corexit 9527 dispersant	IT Corporation

Radio Equipment	
1 - Portable repeater trailer capable of 48 hr independent operation	CB Warehouse
1 - Craftsman multi-band AM receiver*	Union Oil Company Rodeo, CA

Radio Equipment (cont.)	Location
1 - Intech Marine Base Station* (channels 10, 16, 18A & 22A)	Union Oil Company Rodeo, CA
1 - Motorola UHF Mobile Radio	Union Oil Company Rodeo, CA
1 - Intech Scan Receiver (channels* 10, 16, 18A, 22A & WXI)	Union Oil Company Rodeo, CA
10 - Motorola 6-watt packsets* with cases and belts	Union Oil Company Rodeo, CA
2 - Motorola 6-watt packsets* with cases and belts	CB Office

Miscellaneous Equipment	
1 - 8' x 25' Mobile Headquarters office trailer with tandem axle and equipped with various communications equipment	Union Oil Company Rodeo, CA
1 - APTS type tanker lightering system and accessories	CB Warehouse
2 - Wilden 150 gpm spark-free diaphragm pumps-air driven	CB Warehouse
4 - 2", 3" and 6" portable gasoline driven water pumps and hoses	CB Warehouse
1 - 365 cfm air compressor	CB Warehouse
1 - 35' van with various types and quantities of sorbents	IT Corporation
1 - Floodlight trailer with 4-1500 watt lights and diesel driven generator	Diablo Hitch & Trailer
3 - Bird Scare-Away propane cannons	CB Warehouse
1 - Av-Alarm bird scarer device	CB Warehouse

*Radio equipment is stored in Mobile Headquarters Trailer.

3. Clean Coastal Waters Equipment Inventory

BOATS:

M/V RECOVERER

196' Oil Tanker

Storage capacity 10,000 barrels of recovered oil. Can serve as command and supply base for open ocean operations. Accomodations to feed and berth up to 20 people.

2 - 34' Fast Response Boats (Response I and Response II)

10' x 22' open deck
twin 200 hp engines w/200 gals fuel
Radar, VHF Marine Radio, CB Radio, UHF radio.

Each boat can carry 1000' of 3300 Expandi Boom or Kamara Skimmer, seavac oil recovery systems, abosrbent pads, or oil storage bags, along with other equipment for oil containment and recovery.

CLEAN WATERS - 40' Work Boat (Rotork)

9' x 20' open deck
Twin 200 Volvo Diesel engines
Radar, VHF Radio, CB Radio, UHF Radio
Vessel equipped with oil mop and out riggers, oil storage bags, absorbents, etc. Also can be used for boom deployment or to carry other oil recovery equipment.

17' GLASPAR

130 hp engine

Used for supervisory control and reconnaissance

DEDICATED VESSELS AND BOATS (CONTD)

12' ALUMINUM WORK BOAT

15 hp outboard engine

Used for boom surveillance

SKIMMERS:

CLEAN WATERS II - (Marco Class II)

40' self propelled oil ophylic belt type
Storage capacity - 30 bbls.

A highly meneuverable twin hulled catamaran with an endless belt pick up module mounted between the hulls. Can be used as independant recovery device or any length of boom can be connected to each bow of the skimmer and positioned by boats to form a "V" with skimmer at the apex. Excess of oil storage capacity can be pumped into storage bags or to any other vessel.

WALOSEP SKIMMER

Model W3

Recovery capacity - Mfg. Specs. 420 + bbls per hour.

A large 10' x 8' skimmer capable of oil recovery in amy sea state that recovery would be attempted. Skimmer can be operated from any vessel equipped with launching crane and platform large enough to carry or provide onboard hydraulic power source.

050 CYCLONET

Oil recovery system mounted on a self propelled 24' Zodiac boat with twin 50 hp engines.

Oil and water is separated by centrifical force as boat is moved forward through oil to be recovered. Oil is pumped to storage bags or into another vessel.

MARK II SKIMMERS - 2

30' x 14' twin hulled catamarans equipped with weir type skimming system. To be towed with oil boom extensions or tied along side of any motor vessel. Oil is pumped from weir to storage bags or to another vessel. Recovery rates from 50 to 200 gpm.

SKIMMERS (CONTD)

ACME SKIMMERS - 2

Floating weir type skimmers. Hydraulic or gasoline driven.

To be used inside boom to remove confined oil or around docks and ships.

KOMARA SKIMMERS - 2

Floating rotating disc type skimmers operated and controled by hydraulic power. Can be used on open ocean inside boom for oil recovery.

SEAVAC SYSTEM - 4

Slurp skimmer with 2" homlite diaphram pump equipped with 2 - 1200 gal storage bags. Oil-water separator, floats, hoses, etc.

OIL MOP

Can be used with up to 1000' of rope mop to be used around docks and ships where rope can be anchored or tied.

CONTAINMENT BOOMS:

VIKOMA SEAPACKS - 5

2 Trailer mounted - 1 - SC-PCO Yard/1 - Chevron El Segundo

1 Trailer mounted - Twin Harbors, Catalina Island

2 SC-PCO yard

1600' open ocean boom mounted in a 23' planing hull for fast response. Can be towed and deployed with any vessel of oportunity.

GOODYEAR BOOM - 12" x 24"

3100' heavy duty open ocean boom. Stowed on dock for immediate deployment.

Can be used for harbor protection or open ocean. Boom material can withstand chafing against riprap, pilings, etc.

CONTAINMENT BOOMS (CONTD)

20" KEPNER BOOM - 5000'

Stowed on docks for immediate deployment.

14" KEPNER BOOM - 5000'

Stowed on dock for immediate deployment

14" x 17" EXPANDI BOOM - 15,000'

Stowed on five trailers to be towed to any spill site for deployment.

16" x 23" KEPNER COMPACTI BOOM - 4100'

Stowed in covered van for transfer and deployment.

20" x 23" EXPANDI BOOM - 1000'

Stowed at Twin Harbors, Catalina Island

CONWED SORBENT BOOM - 200'

Stowed at Twin Harbors, Catalina Island.

TELECOMMUNICATIONS

The CCW/SC-PCO Communications Equipment is located at
320 W. 5th Street, Suite 302, San Pedro, California 90731.

The equipment consists of two frequencies:

1) the Logistics Network - is VHF channel - 158.445/159.000, call sign KCD 770. The Logistics nework is dedicated to providing person to person contact for the Cleanup Manager, Cleanup Coordinator and designated supervisors on the cleanup team. The Logistics network is a wide range system that serves as a contact between Manager and Coordinator. It is aided by a repeater on Catalina Island.

2) the Operations Network - is UHF channel - 454.000/459.000, call sign KDG 714. The Operations network is designed to provide wide coverage via repeaters on Catalina Island, interconnecting all stations and units concerned with support of the cleanup team. It might be compared to a portable long distance telephone system, such as a tie line between company offices in different cities.

A permanent repeater station (continuous operating) is located atop Catalina Island to insure good coverage of the CCW/SC-PCO area of interest. Two portable trailers wtih two repeaters per trailer - one main and one stand-by, are battery powered with a built-in charger and need an AC source to charge the batteries. Both are on the UHF frequency and are stored at CCW/SC-PCO storage area in San Pedro.

Base/Control Units

1. Two units at CCW/SC-PCO office (1 Logistics/1 Operational)
2. One unit at Aqua Contractors (1 Operational)
3. Two units at Catalina Isthmus (1 Logistics/1 Operational)

Mobile Units

1. Two units in General Manager's car (1 Logistics/1 Operational)
2. Two units in Aqua Contractor's truck (1 Logistics/1 Operational)

Portable Units

1.	21 units at SC/PCO/CCW offices	2 Logistics	19 Operational
2.	1 unit at Aqua Contractors office	1 Logistics	
3.	4 units at Crowley office	1 Logistics	3 Operational
4.	3 units at Catalina Two Harbors		3 Operational
5.	4 units at San Diego Contractor office		4 Operational
6.	2 units at Shell Beta Platform		2 Operational

1 - 45 channel Marine radio Call Sign WQA 870 (Channel 79)

4. COAST GUARD PACIFIC STRIKE TEAM

COAST GUARD PACIFIC STRIKE TEAM

EQUIPMENT MANUAL

TABLE OF CONTENTS

4. Prime Mover

5. Retrieval / recovery rack

6. Spare parts boxes

B. Lockheed Clean sweep 4000 (OWORS)

C. Dracone Barges

Section IV. SKIMMING DEVICES

A. Marco Class I Skimmer

B. Seavac Skimmer System

C. Acme Floating Saucer Skimmer

D. Vac-U-Max

Section V. PUMPS

A. Double Diaphram

1. Wilden

2. Warren-Rump "Sandpiper"

B. Homelite 385 Trash Pump

C. Multiquip Trash Pump

D. Gormann-Rupp Self-Priming Centrifugal Pump

Section VI. GENERATORS

A. Homelite 3500

Section VII. COMPRESSORS

A. OSI Compressor

B. Mako K-51

C. Bauer Mariner - D

Section VIII. BOATS AND OUTBOARD MOTORS

A. Monarch Utility Boat (TAN-B)

B. Zodiac Inflatable Boats

C. Outboard Motors

Section IX. VEHICLES AND TRAILERS

A. GENERAL Five Star Tractor, 1978

B. Low Bed Semi Trailer

C. Mobile Command Post

D. Chemical Response Van

Section X. CHEMICAL RESPONSE SAFETY EQUIPMENT

A. Self Contained Breathing Apparatus

B. Scott Air Line Respirator (CASCADE SYSTEM)

C. Robert Shaw Emergency Escape Breathing Aparatus

D. Air Purifying Respirators

E. Encapsulated Suits

F. Splash Gear

G. Monitoring Equipment

1. Combustible Gas / Oxygen Level Indicators

2. HNU Photoionization Analyzer

3. Draeger Multigas Detectors

4. PH Meter, Digital, Mini, VWR Scientific Inc. Model 55

Section XI. COMMUNICATIONS EQUIPMENT AND DOCUMENTATION

A. Communications Equipment

1. FM Radios (Tritons and MX-350's)

2. Telecopiers

B. Documentation Equipment

1. Cameras

2. Tape Recorders

3. Video Tape Recording System

C. Miniterminal

Section XII. Auxiliary Equipment

A. Modular Cargo Platforms (Aircraft Pallets)

B. Cargo Nets

C. Spur Gear Hand Winch

D. Aircraft Loading Ramps

E. X-4 Containers (Conex Boxes)

F. ADAPTS helicopter Platform (Helo Delivery Kit)

G. Fenders, OSI TYPE

H. Drum, Fabric Collapsible

Section I. AIR DELIVERABLE ANTI-POLLUTION TRANSFER SYSTEM ADAPTS

The ADAPTS as a complete package is transportable to a site be various modes and is capable of pumping almost any type product utilizing the proper components parts. The ADAPTS is always maintained in a ready status. Four complete systems with spare parts are packaged on a 30 foot low-Boy flat bed trailer for immediate dispatch by tractor or for loading onto a C-130 Aircraft.

A. ADAPTS PRIME MOVER

This is the power source for the ADAPTS system. It consists of an air-cooled AVCO-LYCOMING Diesel engine (Model W-44) which is rated at 40 hp @ 3000 rpm. The engine in turn drives a DeLaval Lucas Hydraulic Pump. The pumped hydraulic fluid drives a Denision Motor which is part of the submersible pump. The engine is equipped with spark arrestors allowing operation in a volatile atmosphere.

PRIME MOVER CHARACTERISTICS:

	TYPE I	TYPE II
WEIGHT	1350 lbs	1150 lbs
DEMENSIONS	49"X44"X44"	51"X44"X48"
CUBES	54 Cubic Feet	62 Cubic Feet
HYDRAULIC PRESSURE RATING	2200 PSIG	2200 PSIG
FLUID OPERATING TEMPERATURE	120-140 F 50-120F (Arctic)	120-140 F 50-120F (Arctic)
FUEL SUPPLY	6 Gallon Diesel	Fuel Bladder Separate
FUEL CONSUMPTION	3 Gallons per hr	3 Gallons per hr

The Pacific Strike Team maintains (06) Prime Movers (03) of each type. Type I can be sling loaded only by a HH-3F Helicopter, while type II can be loaded inside and delivered.

B. SUBMERSIBLE PUMPS

There are six (06) types of pumps in this category which can be driven by the ADAPTS prime mover. However, three of the pumps were designed to be used with the VOPS system and are therefore discussed in the next section. The type of product being pumped and the capability desired will determine which of these pumps is used in conjunction with the prime mover.

NOTE: The diameter of these pumps is such that they all can be lowered through buttersworths and hatches aboard vessels.

1. Single Stage

This is an eight inch diameter, mixed flow pump driven be a hydraulic motor through an enclosed direct drive coupling. The suction intake is located 18 inches above the bottom of the pump housing. PST maintains four (04) of these type pumps.

WEIGHT: PUMP ONLY:	265 lbs; w/box: 353 lbs
DIMENSIONS	13.5"X19.5"X59"
CUBES	7.7 Cubic Feet
PUMPING RATE	750 - 1500 GPM (dependent upon the product viscosity) Over 40 feet of vertical lift push, rate will decrease.
DISCHARGE FITTINGS	6 Inch Quick-Disconnect

2. DOUBLE STAGE

This is a ten inch diameter, two stage, mixed flow pump driven be a hydraulic motor through an enclosed direct drive coupling. The suction intake is located 24 inches above the bottom of the pump housing. PST maintains eight (08) of these type pumps.

WEIGHT: PUMP ONLY:	500 lbs; w/box: 614 lbs
DIMENSIONS	20"X20"X113"
CUBES	26.1 Cubic Feet
PUMPING RATE	900-1645 GPM (depending upon product viscosity and temp.) Over 65 feet vertical push, rate will decrease.
DISCHARGE FITTINGS	6 inch quick-disconnect

3. STRIPPING PUMP

This is an eight inch diameter, single stage, mixed-flow pump driven by an hydraulic motor through an enclosed direct drive coupling. The suction intake is on the bottom of the pump housing and is capable of stripping a tank's product to within 3 or 4 inches of the tank bottom. PST maintains three (03) of these type pumps.

WEIGHT: PUMP ONLY:	300 lbs; w/box: 300 lbs
DIMENSIONS	18"X20"X66"
CUBES	12.6 Cubic Feet
PUMPING RATE	600-1330 GPM (dependent upon product viscosity and temp) Over 20 feet vertical push, rate will decrease.
DISCHARGE FITTING	6 inch quick-disconnect

C. SUPPORTING EQUIPMENT

The prime mover and submersible pump are the primary parts of the ADAPTS system, However, several other parts such as hydraulic hose, discharge hose, fuel bladder, tripod, and rigging material are intergral parts for operation. Some of these items are packed in a connex box for deployment while some are loaded individually due to their size.

1. HYDRAULIC HOSE

The main hydraulic supply and return line for the submersible pumps is through high pressure hose with Quick Disconnect coupling. The working pressure is approximately 2200 PSI. Check valves are built into the couplings which allows the hose to be maintained in a fully charged state. PST maintains 22 eighty foot sections and 19 one hundred foot sections of this hardrubber reinforced hose.

WEIGHT	150 lbs (100 ft); 120 lbs (80 ft)
CUBES	2.5 - 3.0 Cubic feet depending on the diameter of the coil

2. DISHCARGE HOSE

The discharge hose used on the submersible pumps is 6 inch diameter and comes in 50 foot lengths. It is tested to 125 psi but is used in a working pressure mode of approximately 50 psi. The hose is equipped with Quick-Disconnect fittings. PST maintains 58 section of this hose.

WEIGHT	120 lbs (50 ft)
CUBES	7.0 Cubic Feet

3. FUEL BLADDERS

These 55 gallon capacity rubber bladders are used as the fuel source for the ADAPTS prime movers. PST maintains six (06) of these fuel bladders.

WEIGHT	420 lbs (full) 42 lbs (empty)
CUBES	11 Cubic Feet

4. TRIPODS

To enable the lowering of a pump into tanks aboard a vessel or barge, a tripod with appropriate rigging material is used to support the weight. The tripod module has extendable steel legs, allowing the height of the tripod to be set between 8 ft 7 inches and 14 feet. Wire pennants are used to secure the base of the legs.

WEIGHT	175 lbs
CUBES	12 cubic feet
CAPACITY	9000 lbs (10'); 6000 lbs (14')

One leg of the tripod can be removed to make an A-frame configuration for other loading tasks. In this arrangement the capacity is reduced to approximately 2000 lbs at mid-height and 1500 lbs at maximum height, also depending upon the line used to support the A-frame.
PST Maintains nine (09) tripod modules.

5. RIGGING BOX

A rigging box containing all necessary equipment to move or secure ADAPTS components accompanies the system on any response. Items included in the box are: griphoists, lugalls, aircraft straps, chain, A-frame heads, snatch blocks, wire straps, line, shackles, splicing kit, nylon slings, stoppers, and lifting briddles.

WEIGHT	500 lbs approx, depending on number /type of items
CUBES	21.5 cubic feet

Section II. VISCOUS OIL PUMPING SYSTEM (VOPS)

The VOPS has the capability to pump high viscosity petroleum products. The system is similar in concept to ADAPTS, and is basically an enlarged version of it. It also shares some of the components with the ADAPTS. The VOPS prime mover is GM-4-53 water cooled diesel engine driving a commercial shearing gear type hydraulic pump.

The VOPS will operate any of the submersible pumps; two pumps at 26 GPM or one pump at 50 GPM Hydraulic fluid) PST maintains (01) of these type systems.

WEIGHT	4100 lbs
CUBES	96 cubic feet
ENGINE	Detroit diesel allison (04) cylinder
HORSEPOWER	87 hp (continuous)
FUEL SUPPLY	20 gals
HYDRAULIC RESERVOIR	50 gals
HYDRAULIC SYSTEM	(02) section pump
HYDRAULIC FLOW RATE	26 GPM each pump section at 2200 RPM
COOLING	water
HYDRAULIC PRESS.	2500 PSI at 26 GPM (max)
FLUID OPERATING TEMPERATURE	160 - 185 F
OIL PRESSURE	4 - 50 PSI
ENGINE SPEED	2200 RPM

A. SUBMERSIBLE PUMPS

The three (03) type pumps designed for use primarily with the VOPS are described in this section. These, can also, be operated with the ADAPTS prime mover.

1. EUREKA PUMP

This a twelve inch diameter, single stage, mixed flow pump driven by a hydraulic motor through an enclosed direct drive coupling. The suction intake is on the bottom of the pump housing and is capable of stripping a tank's product to within 3 or 4 inches of the tank bottom. PST maintains one (01) of this type pump.

WEIGHT:	PUMP ONLY:	280 lbs; w/box:370 lbs
DIMENSIONS		21"X23"X54"
CUBES		15.1 Cubic Feet
PUMPING RATE		465 GPM at 50 PSI
DISCHARGE FITTING		6 inch Quick-Disconnect

2. SLOANE PUMP

This is a twenty inch diameter, trash pump driven by a hydraulic motor. The suction is located on the lower most end of the pump. The PST maintains (02) of these type pumps.

WEIGHT	PUMP ONLY	140 lbs; w/box 230 lbs
DIMENSIONS		27"X27"X31"
CUBES		13.1 Cubic Feet
PUMPING RATE		800 GPM at 60 ft head at 2000 PSI 980 GPM at 40 ft head at 2000 PSI
DISCHARGE FITTING		6 Inch Quick-Disconnect

3. FRAMO TK-5 PUMP

This is a twelve inch diameter, corrosive chemical pump that will also pump viscous oils and fluids of high temperature. The construction is of stainless steel and its diameter allows it to fit through butterworths openings. The PST maintains (02) of these type pumps.

WEIGHT:	PUMP ONLY:	155 lbs; w/box: 245 lbs
DIMENSIONS		20"X22"X56"
CUBES		14.3 Cubic Feet
PUMPING RATE		1147 GPM at 40 ft head at 2500 P. 794 GPM at 80 ft head at 2500 P.
DISCHARGE FITTINGS		6 inch Quick-Disconnect w/ 4" adapter

NOTE: Hydraulic hoses and discharge hoses also available in braided stainless steel, for this pump.

The supplementary parts required to make a complete ADAPTS system are also required to complete the VOPS. The VOPS is maintained in a ready response mode and is part of the 30 ft. low-boy flat bed trailer package described in the previous section. Either System may then be used on response depending upon what the situation/products warrants.

The VOPS is not deliverable by HH-3F Helicopter.

Section III. OPEN WATER CONTAINMENT AND RECOVERY SYSTEMS (OWOCRS AND OWORS)

The containment and recovery systems described in this section have been designed for and are mainly used for the recovery of oil spilled off-shore. The devices can be used in protected waters, however. The Dracone barges described in Section (C) are not specifically part of the other systems described but are compatible with them and can be used as a containment vessel for the recovered product. As will be noted in their descriptions, special handling and support equipment are required for the proper deployment and operation of these systems

A. OPEN WATER OIL CONTAINMENT AND RECOVERY SYSTEM

OWOCRS

1. OWOCRS BARRIER: This is a "High Seas" Barrier 612 feet in length. It is of fairly rigid construction with a draft of 27 inches and freeboard of 21 inches. Self-inflating floatation bags are part of the system and Nylon lines are used for Tension Slack Retainer, Bridle, and Extension lines. The barrier consists of 102 struts with six (06) designed as skimming struts (Weir type) which are located in the middle of the barrier.

   The Barrier is stowed in an aluminum construction box, ready for deployment. The box includes flotation devices if needed and is Air Deliverable. The OWOCRS Barrier was designed to operate in 6 foot seas and can survive 10-12 foot seas. The Barrier can be deployed in a dynamic mode or a static mode. A mooring system utilizing 90 lb Danforth Anchors, mooring buoys, and appropriate lighting is available if needed during extended use. As can be noted from the weights and dimensions, a large staging area, heavy load handling equipment, and appropriate support vessels are needed for the proper operation of this barrier. PST maintains nine (09) of these barriers.

BARRIER:-	Length	612 feet
	Height	4 feet - draft 27 in. freeboard 21 in
	Weight	11,000 lbs(approx), 110 lb struts
	Flotation bag	4 feet long, 13 in. diameter Inflation at 5-6 psi, with CO_2 cartridges.

BARRIER BOX:	Length	18 feet, 4 in.
	Width	9 feet, 2 in.
	Height	5 feet, 2 in.
	Cubes	875 Cubic feet
	Weight	4500-5000 lbs (approx) depending on container type

2. FAST SURFACE DELIVERY SYSTEM (FSD)

This delivery vessel or "Sled" was designed by the Coast Guard to provide an alternative delivery method for the ADAPTS, OWOCRS Barrier and the OWORS Skimmer. With an aluminum planning hull of 45 foot length and 15 foot beam, it can deliver up to a 20,000 lb payload. The sled can be towed by a HH-3F Helicopter at a speed of up to 50 knots or a surface vessel at up to approximately 30 knots. Compartments in the vessel can be flooded to allow the payload to float free. PST does not maintain any of these devices as they are pre-staged at selected sites (MSO's/COTP's).

LENGTH	47 feet
BEAM	15 feet
CARGO DECK	28 feet X 9 feet
DRAFT	1.5 feet empty, 11 feet stern flooded
WEIGHT	10,000 lbs
CAPACITY	20,000 lbs Payload

3. PUMPING SUBSYSTEM (PUMP FLOAT)

The pump float used in conjunction with the skimming barrier is a 14 foot aluminum flat bottom, barge type work boat. It is without an engine recess or any other type of maneuvering accessories. The pump float requires towing to position and securing to the skimming barrier. To accommodate the Six (06) weir type skimmers in the barrier, the pump float contains three (03) double action , single diaphram pumps. The pumps are hydraulically driven by a prime mover, which must be located on another platform. The maximum pumping capacity is 825 GPM. Suction and discharge connections utilize 3 in. and 6 in. Quick-Disconnect fittings. PST maintains nine (09) of these pump floats.

LENGTH	14 feet
WIDTH	8 feet
CUBES	336 Cubic Feet
DRAFT	1 foot (approx)
FREEBOARD	2 feet (approx)
WEIGHT	2500 lbs

4. PRIME MOVER: The prime mover used as part of the skimming barrier system is the ADAPTS Prime Mover described in Section I.

5. RETRIEVAL / RECOVERY RACK

A retreival rack with hydraulically driven capstan and a recovery rack are normally used as a single unit to recover the skimming barrier after deployment. The two racks have monorails that interface to facilitate barrier recovery using trolley and clip attachments to the struts of the barrier. The rack frames are constructed of welded aluminum pipe. The retreival rack has a skid-mounted bottom and the recovery rack has additional framework of two-inch galvanized steel pipe with slip on fittings. The recovery rack capacity is for 612 feet of barrier, one complete system. The hydraulic power source for the the retreival rack capstan is the prime mover (ADAPTS). PST maintains one (01) of the retreival racks (w/capstan) and three (03) of the recovery racks.

	RETREIVAL RACK	RECOVERY RACK
LENGTH	4 ft 7 in.	26 ft
WIDTH	8 ft 11 in.	9 ft 1 in.
HEIGHT	8 ft	7 ft 4 in.
WEIGHT	900 lbs	3500 lbs

B. LOCKHEED CLEAN SWEEP 4000 (OWORS)

The OWORS is a self-powered, self-contained pontoon-floated oil recovery device which can operate in open seas or calm water. The hull is rectangular box beam structure of 3/16 inch aluminum alloy. The system is powered by an 88.5 hp Lister Diesel engine. A hydraulic system transfers power from the engine to the machinery. A high pressure air system is used for engine startup and controls and a low pressure system is used for pontoon inflation. Oil recovery is accomplished by two aluminum disc-drums. Oil adheres to the aluminum vanes and is wiped by blades into a collecting trough. An oil recovery weir is part of the system which provides for recovery of low viscosity oil in calm waters. There are two oil collection sumps which are automatically pumped-off by two transfer pumps. Due to limited storage capacity, a containment vessel of some type must be provided in which to pump the recovered oil. Four inflatable pontoons provide the floatation for the system. The inner and outer pontoons are neoprene impregnated nylon fabric. The OWORS must be towed to the area of operation and secured appropriately.

PST maintains one (01) of these units.

	OPERATION	TRANSPORT
BEAM	28 ft	28 ft
LENGTH	27.5 ft	7 ft
HEIGHT	11.5 ft	8.5 ft
CUBES	-----	1666 Cu. Ft.
WEIGHT	17,900 lbs	17,000 lbs
DRAFT	2.25 ft (max)	
FUEL CAPACITY	165 gals	
ENDURANCE AT LOAD	30 hours	
OIL RECOVERY RATE	1,000 GPM (max)	
TRANSFER PUMP CAPACITY	650 GPM each	
OIL SUMP CAPACITY	PORT-350 gal	Stbd- 300 gal

C. DRACONE BARGES

The Dracone barge is a flexible tube designed to carry petroleum products or other liquids with a specific gravity less than 1.0. It is constructed of nylon cord and woven nylon fabric, proofed with weather and abrasion resistant synthetic rubber outside and nitrile rubber inside. Two inflatable buoyancy tubes are fitted inside the nose and tail cone assemblies. These assemblies are of an aluminum alloy and provide a cargo seal, loading/discharge hose, and a means to tow the envelope when deployed. The dracone barge can provide an alternative container for recovered oil. Even though the barges are rolled-up on pallets for storage and transit, heavy load handling equipment is required for its deployment and recovery. A navigation light float needs to be used with the barge, when deployed. The size and number of dracone barges maintained by PST is indicated in the following chart, as well as its other characteristics.

(DRACONE TYPE)	D-10	F	O
LENGTH	103 ft	165 ft	300 ft
DIAMETER	4 ft 8 in.	7 ft 8 in.	13 ft 10 in.
WEIGHT	1715 lbs	5005 lbs	14300 lbs
CUBES	150 cu. ft.	270 cu.ft.	570 cu.ft.
CAPACITY(100%)	12,000 gal	50,400 gal	290,500 gal
OPERATIONAL	10,200 gal	42,840 gal	246,925 gal
NUMBERED MAINTAIND BY PST	1	4	1

SECTION IV. SKIMMING DEVICES

PST maintains several small oil skimming devices which utilize various recovery principles. These skimmers are used mainly in a training mode but are available for response if the incident so dictates.

A. MARCO CLASS I SKIMMER

This inland water service device uses an opleophilic belt to recover product. The belt can be adjusted for raising or lowering 12 inches. A self-contained prime mover operates the skimmer and rollers. This unit requires a small trailer for delivery.

WEIGHT	625 lbs plus 250 lbs for prime mover
DIMENSIONS	15 ft X 3 ft X 4 ft
CUBES	180 cu. ft.
POWER	Hydraulic (compressed air)
SUMP	90 gal
ENGINE	1 cyl. Petter Diesel 6,5 hp @ 3600 rpm
PRESSURE	Nose roller 20 psi SQUEEZER ROLLER 45 psi
HYDRAULIC FLUID	Teresic 46

B. SEAVAC SKIMMER SYSTEM

(Slurp skimmer or Portable Oil Retrieval Transfer System (PORTS))

The PORTS is a complete system with a weir type skimming head, a floating oil water separator, and a 300 gallon storage bladder, The prime mover for the system includes a small diesel engine and a self-priming diaphram pump.

WEIGHT	1250 lbs
DIMENSIONS	7.5 ft X 4 ft X 4 ft
CUBES	120 Cu. Ft.
POWER	1 Cyl. Barnes Diesel 2.4 hp @ 2400 rpm
RECOVERY RATE	30 GPM
MAXIMUM LIFT	20 Ft.

C. ACME FLOATING SAUCER SKIMMER (WEIR TYPE)

This device consists of a floating suction head (Weir Type) with a 4 hp Tecumesh gasoline engine that drives a four inch impeller pump. It can also be powered by compressed air or electricity. A receiving container must be provided for the recovered product.

WEIGHT	500 lbs
DIMENSION	4.3 ft X 4.2 ft X 4.3 ft
CUBES	79 Cu. Ft.
MAXIMUM HEAD	30 Ft
RECOVERY RATE	75 to 120 GPM (Varies according to skimming depth of product)

D. VAC-U-MAX

This device is a portable wet or dry vacuum, useable on petroleum products. Using compressed air of at least 60 psi it creates a vacuum of 8 to 16 inches of mercury which can lift water to about 18 feet The vacuum unit normally includes a 55 gallon drum but it can be adapted to a 275 gallon designed tank. The device has an automatic shut-off so it cannot overflow. A skimming wand can be used with this unit also. PST Maintains two of these units.

WEIGHT	600 lbs
DIMENSIONS	4.3 ft X 4.2 ft X 4.3 ft (both units)
CUBES	79 cu. ft.
RECOVERY RATE	up to 2 GPM
AIR PRESSURE	60 psi or greater

Section V. PUMPS

A. DOUBLE DIAPHRAM PUMPS

1. WILDEN

This pump is a compressed air operated double diaphram pump with a 3 inch discharge. The pump is packaged with discharge hose, fittings, and compressed air line. The OSI compressor described in Section VII will normally be the source of compressed air for the Wilden pump. PST has one (01) of these units.

WEIGHT	500 lbs
DIMENSIONS	4 ft X 4.3 ft X 3.2 ft
CUBES	55 cu. ft.
PUMPING RATE	up to 200 GPM
MAX. LIFT	up to 25 ft
AIR PRESSURE	90-125 psi

2. WARREN RUPP "SANDPIPER"

This double diaphram pump is also operated by compressed air. Two inch fittings and discharge hoses are used with this unit. The OSI compressor also is used to supply compressed air for this pump. PST mantain two (02) of these pumps.

WEIGHT	95 lbs
DIMENSIONS	1.25 ft X 2 ft X 2 ft
CUBES	5 cu. ft.
PUMPING RATE	up to 140 GPM
MAX. LIFT	up to 20 ft
AIR PRESSURE	80 - 100 PSI

B. HOMELITE 385 TRASH PUMP

1. The Homelite 385 is a self-contained pump with a 3 inch discharge. A 6 horsepower, 4 cycle, Briggs and Stratton gasoline engine powers the pump, which is a centrifugal type pump with impeller. The pump must be primed before operating. PST maintains two (02) of these units.

WEIGHT	135 lbs
DIMENSIONS	3 ft X 1.75 ft X 2 ft
CUBES	10.5 cu. ft.
PUMPING RATE	up to 385 GPM
MAX. LIFT	up to 25 ft

C. MULTIQUIP TRASH PUMP

1. The multiquip is a centrifugal stainless steel pump driven by 7.1 hp Farymann diesel engine. This pump can be utilized with corrosive and petro-chemical products. This unit has 3 inch fittings and hoses and is self-priming. PST has one (01) of this type pump.

WEIGHT	217 lbs
DIMENSIONS	1.67 ft X 2.25 ft X 2.5 ft
CUBES	9.4 cu. ft.
PUMPING RATE	up to 200 GPM
MAX. LIFT	up to 25 ft

D. GORMANN-RUPP SELF-PRIMING CENTRIGUGAL PUMP

1. This stainless steel, hydraulic driven pump can be used to move corrosives and petrochemical products. An ADAPTS prime mover is used to power the pump. The suction manifold is 3 inch and the discharge is 4 inch. PST maintains two (02) of these pumps.

WEIGHT	315 lbs
DIMENSIONS	1.5 ft X 4 ft X 3 ft
CUBES	18 cu. ft.
PUMPING RATE	up to 200 GPM
MAX. LIFT	20 ft

Section VI. GENERATORS

A. HOMELITE 3500

1. This generator is powered by an 8.0 hp 4 cycle, Briggs and Stratton gasoline engine. Generator output can be in 120 volts or 240 volts, or both. For maximum power the switch should be in a single voltage mode. 3.5 kilowatts is produced at 60 Hz by this unit and 20 to 30 amperes can be drawn. An automatic idle control allows the engine to operate at the speed necessary to supply power demanded. The generator, must be grounded for safe operation. PST maintains two (02) of these portable generators.

WEIGHT 160 lbs
DIMENSIONS 2.25 ft X 2.25 ft X 1.5 ft

Section VII COMPRESSORS

A. OSI COMPRESSOR

1. The OSI unit is the compressed air source used to power PST's pneumatic tools and air powered pumps. This compressor has a 3 stage Dresser compressor and is powered by a 14.5 hp, 2 cylinder Lister Diesel engine. PST maintains one (01) of these units.

WEIGHT	2350 lbs
DIMENSIONS	5.5 ft X 4.2 ft X 4.2 ft
CUBES	97 cu. ft.
COMPRESSOR RATING	100 cfm at 1800 rpm 125 cfm at 2500 rpm
TANK PSI	up to 200

B. MAKO K-51

1. This high pressure air compressor is one of PST's sources of breathing air for the self-contained breathing apparatus (SCBA'a) held at the unit. The three-stage high pressure machine is powered by a 5 hp Briggs and Stratton gasoline engine. Due to its light weight is quite portable. A Light weight frame is constructed around the compressor and engine to facilitate handling the compressor. PST has one of these units.

WEIGHT 190 lbs

C. <u>BAUER MARINER - D</u>

1. This high pressure, three stage air compressor is another source of breathing air for PST's SCBA's. This unit is powered by an 8 horsepower one cylinder HATZ Diesel engine. A frame encloses the compressor and engine to aid in its portability. PST maintains one of this type.

WEIGHT	320 lbs
DIMENSIONS	50 in X 22 in X 32 in
CUBES	20.4 cu. ft.
PRESSURE	5000 psi
AIRFLOW	7.0 cfm @ 1300 rpm

Section VIII BOAT AND OUTBOARD MOTORS

A. MONARCH UTILITY BOAT (TAN B)

PST maintains one of these 21 foot utility boats or "trailerable Aids to Navigation Boats" This boat is designed witha Cathederal hull for stability and added load capacity and is constructed of marine aluminum. Transferring personnel and equipment and tending boom are some of the possible uses for this boat. A crucifix has been added to the boat, for towing capability. The TAN B is also equiped witha fathometer and triton radio.

LENGTH	21 ft 6 in
BEAM	7 ft 3 in
DEPTH(MOLDED)	3 ft 2 in
(NORMAL)	1 ft 2 in
FREEBOARD	2 ft 0 in
ENGINE	Mercury Cruiser, inboard 165 hp, 6 cyl. Gasoline
FUEL CAPACITY	40 gal
LOAD CAPACITY	12 persons
WEIGHT	2,250 lbs
WEIGHT W/TRAILER	7,080 lbs
LENGTH W/TRAILER	27 ft 6 in
WIDTH W/TRAILER	8 ft 0 in
HEIGHT W/TRAILER	7 ft 11in

B. ZODIAC INFLATABLE BOATS

Two zodiac inflatable boats are maintained by the PST. The two different size zodiacs, which are light, safe, stable, and quite maneuverable, are used to tend the skimming barrier and pump float on a response. Powered by one of the outboards motors described in paragraph C, the zodiacs provide a reliable work platform.

	MARK III	MARK IV GR
LENGTH	15 ft 5 in	17 ft 6 in
LENGTH INSIDE	8 ft 4 in	9 ft 4 in
WIDTH	6 ft 4 in	7 ft 2 in
WIDTH INSIDE	3 ft 0 in	3 ft 6 in
BUOYANCY TUBE DIAMETER	1 ft 8 in	1 ft 10 in
BUOYANCY CHAMBERS	5	5
KEEL, RUBBER	Inflatable	Inflatable
CAPACITY PERSONS	10	12
CAPACITY PAYLOAD	220 lbs	286 lbs
OUTBOARD MOTOR CAPACITY	10 - 65 hp	10 - 85 hp
DIMENSIONS FOLDED	4ftX2ftX11in 3ft10inX2ftX10in	5ftX2ft8inX1ft3in 4ft6inX2ft6inX10in
CUBES	13.5 cu. ft.	25 cu. ft.
WEIGHT	211 lbs	352 lbs

c. OUTBOARD MOTORS

PST maintains four (04) gasoline powered outboard motors to be used on Zodiac Inflatable Boats as described in paragraph b. There are two (02) each Johnson and Envinrude long shaft motors. Portable 5 gallon fuel tanks with priming bulb in-line are used with this motor.

	ENVINRUDE	JOHNSON
DIMENSIONS	2ft X 1.5ft X 4.25ft	2ft X 1ft X 4.25ft
CUBES	12.75 cu. ft.	8.5 cu. ft.
WEIGHT	87 lbs	118 lbs
HORSEPOWER	25	35
STARTING MECHANSIM	Manual	Manual
PROPELLER DIAMETER	10 in	10 in
PROPELLER PITCH		13 in

Section IX VEHICLES AND TRAILERS

The PST maintains a number of vehicles and trailers used in transporting equipment to the scene of a response. All these units are capable of being loaded onto a C-130 airfract. In case of the trailers, some type of mobilizer is needed to off-load the unit at its destination ad a tractor for final delivery to the sight.

A. General 5 STAR TRACTOR, 1978

This GSA-Interagency motor pool semi-tractor is used by PST for over the road delivery of equipment laden trailers. It has been equiped with a moveable fifth wheel, a Jacobs Engine Brake, and a Mercury Sleeper.

MANUFACTURER	GMC
ENGINE	CUMMINGS DIESEL NTCC - 350
TRANSMISSION	FULLER 8 SPEED
HORSEPOWER	350
DRIVER WHEELS	8
FUEL CAPACITY	150 GALS
WEIGHT	20,000 lbs

B. LOW BED SEMI-TRAILER

These low bed trailers manufactured by Transport Trailers are equiped witha 2 inch King Pin towing facility, Air Brakes, and 12 volt DC, 7 pin electrical receptacles. A fifth wheel dolly comes as part of the unit which allows aircraft loading/unloading without a tractor or forklift; but controlled by aircraft winches When a tractor is hooked up for transporting the dolly can be towed from the back of the trailer using the pinto hook. Couplings for air and electrical are located on the after end of the trailer also. The trailer is welded steel construction with a 1-1/2 inch apitong planking deck. PST maintains seven of these units. The trailers are usually loaded in a ready response status with the ADAPTS system, dracon barges, and OWOCRS barriers.

LENGTH	32.7 ft (overall)
	23.5 ft (deck)
	9.2 ft (gooseneck)
WIDTH	8.0 ft (deck)
	3.0 ft (gooseneck)
HEIGHT	5.0 ft (over gooseneck)
	3.0 ft (over deck)
GOOSENECK IS APPROX. 2.0 ft ABOVE DECK	
WEIGHT	7,550 lbs (curb)
	30,550 lbs (GVWR)
AXLES	2 tandem
LANDING GEAR	VERTICAL SCREW, 2 SPEED MANUAL
	16 INCH RETRACTED HEIGHT

C. MOBILE COMMAND POST

PST's mobile command post is a modified 1974 TRAVCO motor home. It has been equiped with air conditioning, heaters, electrical generators, galley, storage cabinets, and counter/dish space to accomodate 4-5 personnel. Wiring has been installed to provide for 3 telephone after connection by the phone company. Six to Eight people can be accommodated for a conference situation if other activities are precluded. A VHF-FM Triton radio with appropriate antenna is installed to provide for a 25 watt base station capability. It is possible to provide berthing for 2 persons on board, but not recommended. The MCP is C-130 air deliverable.

LENGTH	32.0 ft (overall) 209 inch (17.4 ft) wheel base
WIDTH	8.0 ft
HEIGHT	9 ft 1 in
WEIGHT	13,770 lbs
ENGINE	440 CID CHRYSLER
HORSEPOWER	240 hp
TRANSMISSION	3 speed automatic)Loadflite)
FUEL CAPACITY	80 GALS
GENERATOR	ONAN 6000 WATT, 50 amp
WATER SUPPLY	26 gal tank 6 gal heater

D. CHEMICAL RESPONSE VAN

PST has modified a 20 foot shipping container into a chemical response van. The container is placed atop a low bed trailer for over-the-road response or palletized for C-130 delivery. Power is supplied to the van by a portable generator. The container also, has forced ventilation, a 15 gallon water supply and a mini-weather station. The van is so arranged that most of the space is used for chemical response equipment storage. Items described in section X are found in the van in addition to a considerable amount of other supportive equipment. The outfitting of the response van is such that 6 personnel could be supported at a chemical response for a period of at least one week. Work space inside the van is restricted therefore, this unit would not serve effectively as a command post.

LENGTH	21 ft 8 in
WIDTH	8 ft 6 in
HEIGHT	7 ft 10 in
WEIGHT	10,000 lbs

Section X CHEMICAL RESPONSE SAFETY EQUIPMENT

PST's chemical response equipment inventory includes a great number of items that would be used on a hazardous material response. Considering this, only the major items and those most used will be described in this section. Other supportive materials include reference books, repair tools, spare SCBA and instrument parts, TYVEK Coveralls, portable eyewash, portable shower, decontanmination materials, digital blood pressure monitor, digital thermometer, and other items to numerous to mention.

A. SELF-CONTAINED BREATING APPARATUS

Three types of SCBA's are maintained by PST: Survivair Model, Survivair XL-60, 60 minute model, and the MSA 30 minute unit. Each is a pressure Demand unit. A number of spare air bottles of steel or composite structure are kept for each type SCBA. Eleven (11) Survivair 30 minute units are kept in the chemical response van. The remaining Survivair 30 minutes units (01), six (06) Survivair XL-60's and the four (04) MSA 30 minute units are maintained in a ready status in the response equipment storage.

B. SCOTT AIR LINE RESPIRATOR (CASCADE)

PST maintains three (03) Scott Air Line Respirators with 5 - minute escape bottles. These breathing apparatus can be connected by 300 feet of high pressure air hose to air sylinders charged to at least 2100 psi (225 Cubic Feet). With two cylinders used in this mode, a breathing air supply of up to approximately 4 hours can be provided.

C. ROBERT SHAW EMERGENCY ESCAPE BREATHING APPARATUS

This 5-minute escape pack provides breathing air for a person to exit only from hazardous atmoshpere. The unit is carried in a pack over the shoulder and can be slipped over the head in seconds for use. PST maintains 16 of these units.

D. AIR PURIFYING

Three types of Air Purifying Respirators are kept in PST'a inventory: the MSA Full face twin cartridge respirator, the MSA full face gas mask(with type N canisters) and the Scott Full Face Twin Cartridge Respirator. 40 units total are maintained and cartiridges/canisters for organic vapors, acid/gas and particulates are kept in stock.

E. ENCAPSULATED SUITS

Many chemical response incidents may require an entry in a fully encapsulated suit. For this situation, PST maintains three (03) types of these suits: The Eastwind Chemturion of Butyl rubber, Eastwind Chemturion of Neoprene and the ILC Dover Walkaround of Chlorinated Polyethylene. Six (06) of the Butyl Rubber suits, Six (06) of the Neoprene, and fourteen (14) of the CPE suits are kept ready at all times.

F. SPLASH GEAR

When a hazardous material incident is not that serious but personnel body protection is still desirable, splash gear is utilized. PST maintains a considerable amount of splash gear of several different types. Some of these items can also be used as rain gear if needed during any type of response. The following chart lists the items of gear and the type of material of which they are composed. No attempt is made to list the number of pieces in stock due to the fluctuation that can occur.

	NEOPRENE	POLYVINYL CHLORIDE	NITRILE	BUTYL RUBBER
COVERALLS, ONE PIECE	X			
JACKETS		X		
OVERALLS, BIB TYPE		X		
HOODS		X		
GLOVES	X		X	
BOOTS, W/STEEL SHANK &TOE	X		X	
OVER_BOOTS		X		X

Section XI. COMMUNICATIONS AND DOCUMENTATION EQUIPMENT

A number of pieces of equipment are used by PST in the field to facilitate communication between the OSC and his staff and other resources and to document events in a case and progress in cleanup. Several OSC kits, containing all necessary administrative/office supplies have been put together and could be considered an item in this section, although not described. A typewriter can also be released from the unit to accompany personnel if needed.

A. COMMUNICATIONS EQUIPMENT

1. FM RADIOS: PST maintains four (04) Modar Triton radios for use in vehicles or setting up as a 25 watt base station in the field. More portable communications is obtained by using Motorola MX-350 hand-held radios. Twenty-four (24) of these radios are available. A number of frequencies/channels are utilized on the radios including channels 16, 21, 22, 23, 81, and 83.

   Auxilliary equipment used with the MX-350 radios make them more versitile. Belt holders and hand-held microphones can be used. Transmit/Receive handsets for use during aircraft operations are on hand for use also. Setcoms, which are "Bone" activated transmit and earphone receive, can be attached to the MX-350's for use when a chemical response demands encapsulated suits. Charging units are maintained to accommodate all radios on hand.

2. TELECOPIERS: Two (02) different telecopier machines are held by PST for the purpose of sending or receiving messages or other printed material over a telephone during a response, when a teletype is not available and time requirements preclude personnel from delivering the information.

The 3M model 603 "VRC" Portable Remote Copier operates on 115V AC or 12V DC. This machine can be set on 3, 4, or 6 minute mode for compatability with most other types of telecopiers. 3M brand copy paper must be used for receiving.

The Exxon Enterprises Inc Qwip 1200 series telecopier operates on 110/115V AV only. It has only 4 and 6 minute send/receive modes but is compatible with most any telecopying machine. Exxon or Xerox paper may be used for receiving messages on this machine.

B. DOCUMENTATION EQUIPMENT

1. CAMERAS: POLAROID Model 440

Pentax Spotmatic, 35mm

Canon AE-1, 35mm

PST maintains three (03) each of the above cameras with flash attachments and extra lenses.

2. TAPE RECORDERS: SONY, Portable Cassette, Two)02) units are kept on hand for response.

3. VIDEO TAPE RECORDING SYSTEM: PST maintains a complete Video Tape Recording System with 1/2 inch tape and 3/4 inch tape capability components include: Sony VP-2000 VTR, and a Sony SLP-300VTR. This system is used primarily in training programs but could be used in recording field activity.

C. MINITERM:

A Computer Devices Inc Miniterm is maintained by PST. With this device, access gan be gained by telephone link to the Spill Cleanup Equipment Inventory System (SKIM) and computerized Chemical Information System CIS. A single copy printout is received when accessing the system.

Section XII **AUXILIARY EQUIPMENT**

A number of pieces of equipment maintained by PST are used in loading and transporting materials to the scene of a response. This section examines several of those items. Also, a few support items that would be used on scene are described. By no means are all support type items used by PST described as the list would be too extensive and most are for the units internal use.

A. MODULAR CARGO PLATFORM (AIRCRAFT PALLETS)

These aluminum alloy pallets constructed in two foot panels, are used by PST for unitizing several pieces of equipment for aircraft shipment. The panels are of a standard 9 ft wide adaptable to most any cargo aircraft and can be interlocked to provide pallets of four foot to twenty-eight foot lengths, in two foot incriments. Several one piece pallets seven foot long are also used by PST. Each pallet has recessed tie down rings and provides for locking side rails. The empty pallet Weight is approximately 75 lbs per linear foot.

B. CARGO NETS

Aircraft cargo nets normally come in three sections PST utilizes only the top section of these nets to secure loads on the pallets described above. These top nets are made of nylon and are 9 ft by 9 ft. They have metal rings for securing spaced around the edge of the net.

C. SPUR GEAR HAND WINCH

PST maintains two of these winches for use in loading and off loading aircraft where a pulling force is needed. Utilizing 1/2 inch wire rope these winches have a load rating of 10,000 pounds.

D. AIRCRAFT LOADING RAMPS

Two specially constructed ramps of 3/16 inch aluminum, which match up with the lowered tail section of a C-130 aircraft are used for vehicular loading or unloading of such aircraft. The ramps height of 1.5 ft and length of 16 ft gives an incline of approximately 25,000 lbs. PST has two sets of these ramps.

E. X-4 CONTAINERS (CONEX BOXES)

These containers constructed of reinforced plastic (fiberglass), are used for transporting spare parts and small pieces of equipment. They can be loaded with material up to 4000 lbs in weight and 200 cubic feet in volume. PST has four (04) of these containers.

EMPTY WEIGHT	920 lbs
OVERALL LENGTH	8 ft 8 in
OVERALL WIDTH	5 ft 10 in
OVERALL HEIGHT	5 ft 5 in
OVERALL CUBIC FEET	272

F. ADAPTS HELICOPTER PLATFORM (HELO DELIVERY KIT)

The ADAPTS type II Prime movers maintained by PST are equiped with a "Bomb rack" which makes them H-3 helicopter deliveriable. However, some extra modification are needed on the H-3 to accommodate this. The delivery kit contains all the required items to complete the system. The main items are a platform, on which the prime mover sets in the cargo bay, and a bracket conveyor assembly which converts the H-3's winch and cable to a double fall system vice a single fall system. The bomb rack on the prime mover also allows a pump to be attached for delivery at the same time. PST has two (02) of these Helo delivery kits.

G. FENDERS, OSI TYPE

These Ocean System Inc. Fenders, constructed of polyurethane, are used when a small support vessel being used by PST must tie-up along side another vessel.

DIMENSIONS	8 ft diameter	12 foot length
WEIGHT	1650 lbs	

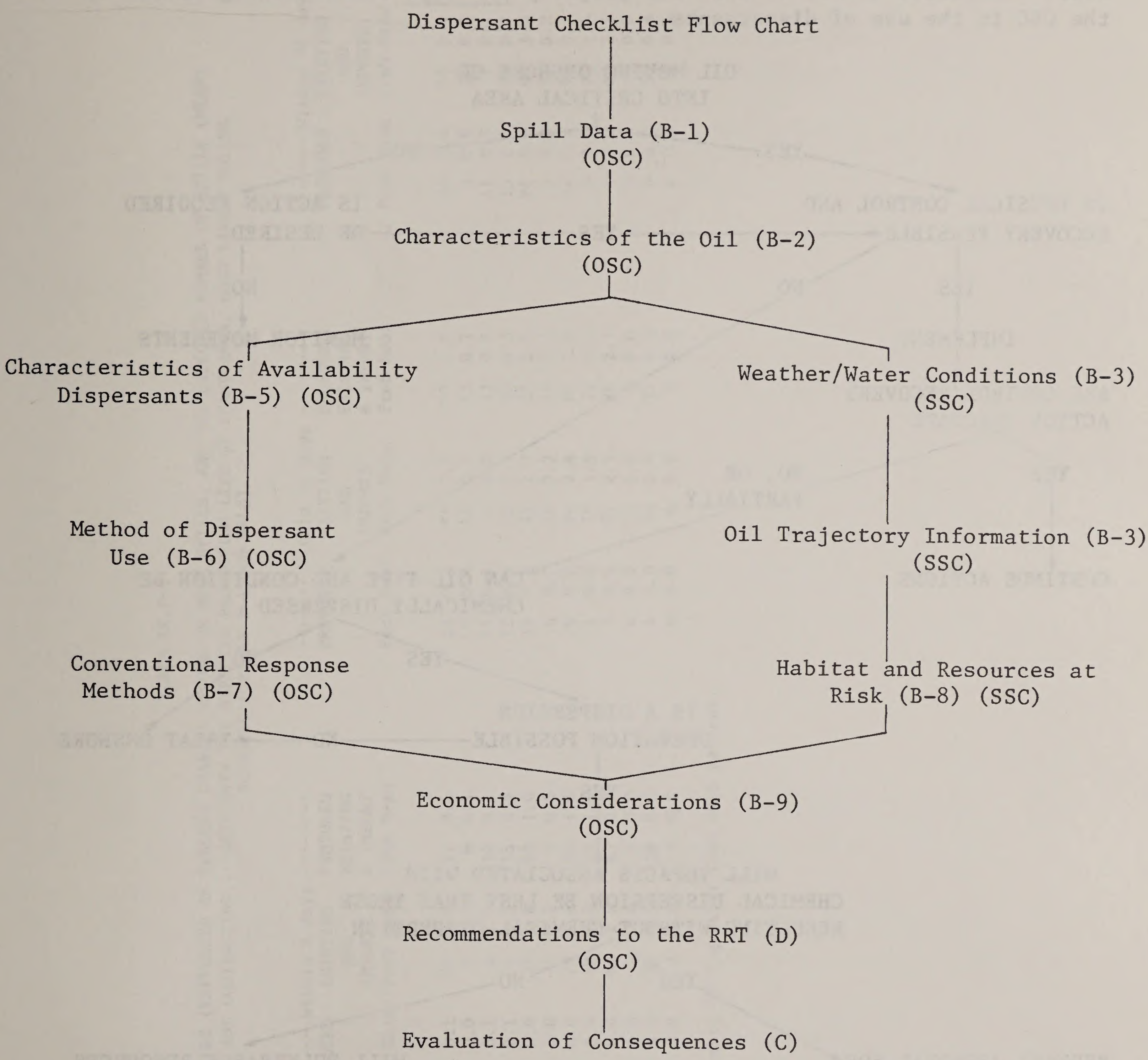
PST has three (03) of these fenders.

H. DRUM, FABRIC, COLLAPSIBLE

This durable novented collapsible container is constructed of fabric impregnated with fuel resistant sythetic rubber. Designed to store or haul fuels it could alos be used as a receiving vessel for small amounts of waste product. It is equipped with closure plates which allow attachment of a yoke for towing as a "Liquid Wheel" or for lifting. PST has eight (08) of these drums.

CAPACITY	500 gal
WEIGHT EMPTY	275 lbs
W/GASOLINE	3,275 lbs (approx)
LENGTH	5 ft 2 in
DIAMETER	4 ft 5-1/8 in
WORKING PRESSURE	30 psi Max Press. 45 psi
MANUFACTURER	UNIROYAL

E. Dispersant Approval Guidelines



(RRT)

* from Region IX Oil and Hazardous Substance Pollution - Contingency Plan

The following steps should be utilized in deciding if the use of dispersants will be requested.

NOTE: Immediate threat to life and property pre-empt the following matrix by the OSC in the use of dispersants.

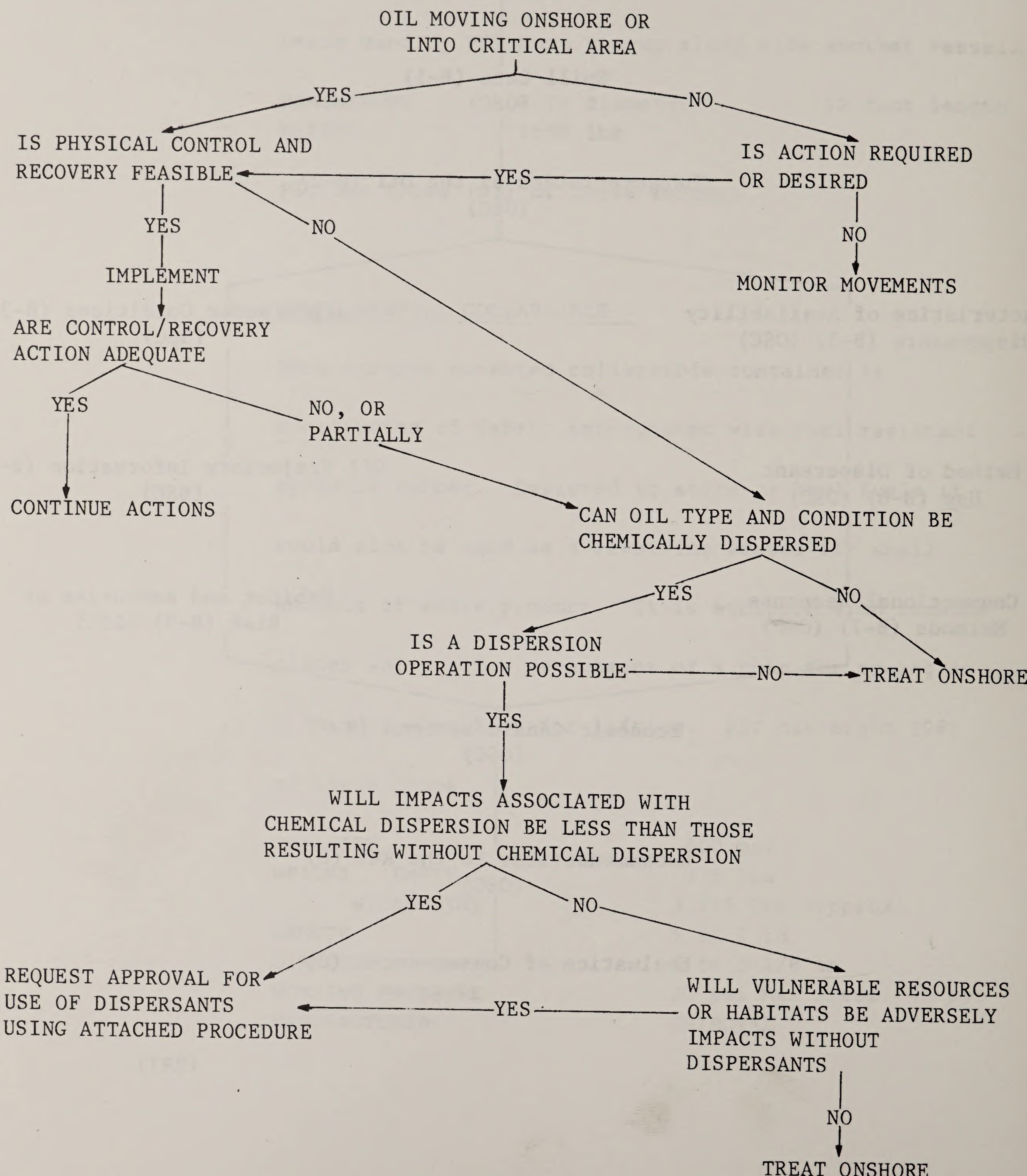


TABLE IX.F-1

PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTRACTING TARGETS OVER THE EXPECTED PRODUCTION LIFE OF LEASE AREA, MOST LIKELY VOLUME SCENARIO (SPILLS ≥ 1,000 BBLS)

Target	------- Within 3 days --------						------- Within 10 days --------						------- Within 30 days --------					
	PROPOSED		EXISTING AND IMPORTS		PROPOSED EXISTING & IMPORT		PROPOSED		EXISTING AND IMPORTS		PROPOSED EXISTING & IMPORT		PROPOSED		EXISTING AND IMPORTS		PROPOSED EXISTING & IMPORT	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	12	0.1	97	3.4	97	3.6	23	0.3	**	7.5	**	7.8	34	0.4	**	9.9	**	10.3
N. Sea Otter Range	1	0.0	5	0.1	6	0.1	2	0.0	11	0.1	13	0.1	3	0.0	16	0.2	18	0.2
S. Sea Otter Range	10	0.1	n	0.0	10	0.1	11	0.1	1	0.0	12	0.1	11	0.1	7	0.1	17	0.2
Sea Otter Range	10	0.1	6	0.1	15	0.2	12	0.1	12	0.1	22	0.3	13	0.1	20	0.2	30	0.4
N. Channel Islands	2	0.0	79	1.6	80	1.6	15	0.2	93	2.7	94	2.9	26	0.3	95	3.0	96	3.3
S. Channel Islands	n	0.0	4	0.0	4	0.0	n	0.0	14	0.2	14	0.2	n	0.0	16	0.2	16	0.2
Channel Islands	2	0.0	79	1.6	80	1.6	16	0.2	94	2.8	95	3.0	26	0.3	96	3.1	97	3.4
Pt. Reyes Mar. Sanct.	1	0.0	77	1.5	77	1.5	1	0.0	79	1.5	79	1.5	1	0.0	79	1.6	80	1.6
Pt. Reyes Wild. Area	1	0.0	87	2.0	87	2.0	1	0.0	87	2.1	88	2.1	1	0.0	88	2.1	88	2.2
Farallon Islands	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	3	0.0	n	0.0	3	0.0	3	0.0
Least Tern Range	4	0.0	25	0.3	28	0.3	4	0.0	30	0.4	32	0.4	4	0.0	30	0.4	33	0.4
Begg Rock	n	0.0	1	0.0	1	0.0	n	0.0	4	0.0	4	0.0	n	0.0	7	0.1	8	0.1

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

TABLE IX.F-2

PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, AND THE EXPECTED NUMBER OF SPILLS (MEAN) OCCURRING AND CONTACTING LAND SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, MOST LIKELY VOLUME SCENARIO

Land Segment	Within 3 days: PROPOSED Prob	Within 3 days: PROPOSED Mean	Within 3 days: EXISTING AND IMPORTS Prob	Within 3 days: EXISTING AND IMPORTS Mean	Within 3 days: PROPOSED EXISTING & IMPORT Prob	Within 3 days: PROPOSED EXISTING & IMPORT Mean
1	n	0.0	1	0.0	1	0.0
2	n	0.0	1	0.0	1	0.0
3	n	0.0	5	0.0	5	0.0
4	n	0.0	4	0.0	4	0.0
5	n	0.0	8	0.1	8	0.1
6	n	0.0	6	0.1	6	0.1
7	n	0.0	1	0.0	1	0.0
8	n	0.0	n	0.0	n	0.0
9	n	0.0	n	0.0	n	0.0
12	n	0.0	n	0.0	n	0.0
13	n	0.0	n	0.0	n	0.0
14	n	0.0	11	0.1	11	0.1
15	n	0.0	46	0.6	46	0.6
16	n	0.0	36	0.4	36	0.4
17	n	0.0	8	0.1	8	0.1
18	n	0.0	11	0.1	11	0.1
19	n	0.0	3	0.0	3	0.0
20	n	0.0	1	0.0	1	0.0
22	n	0.0	n	0.0	n	0.0
23	n	0.0	n	0.0	n	0.0
24	1	0.0	n	0.0	1	0.0
25	7	0.1	n	0.0	7	0.1
26	n	0.0	1	0.0	1	0.0
27	1	0.0	14	0.1	15	0.2
28	n	0.0	19	0.2	19	0.2
29	n	0.0	23	0.3	23	0.3
30	n	0.0	14	0.2	14	0.2
31	n	0.0	2	0.0	2	0.0
32	n	0.0	2	0.0	2	0.0

Land Segment	Within 10 days: PROPOSED Prob	Within 10 days: PROPOSED Mean	Within 10 days: EXISTING AND IMPORTS Prob	Within 10 days: EXISTING AND IMPORTS Mean	Within 10 days: PROPOSED EXISTING & IMPORT Prob	Within 10 days: PROPOSED EXISTING & IMPORT Mean
1	n	0.0	8	0.1	8	0.1
2	n	0.0	5	0.1	5	0.1
3	n	0.0	14	0.2	14	0.2
4	n	0.0	10	0.1	10	0.1
5	n	0.0	13	0.1	13	0.1
6	n	0.0	14	0.2	14	0.2
7	n	0.0	13	0.1	13	0.1
8	n	0.0	3	0.0	3	0.0
9	n	0.0	3	0.0	3	0.0
12	n	0.0	2	0.0	2	0.0
13	n	0.0	1	0.0	1	0.0
14	n	0.0	31	0.4	31	0.4
15	n	0.0	52	0.7	52	0.7
16	n	0.0	44	0.6	44	0.6
17	n	0.0	10	0.1	11	0.1
18	1	0.0	20	0.2	20	0.2
19	1	0.0	12	0.1	12	0.1
20	n	0.0	1	0.0	1	0.0
22	n	0.0	n	0.0	1	0.0
23	1	0.0	1	0.0	2	0.0
24	2	0.0	n	0.0	2	0.0
25	7	0.1	n	0.0	7	0.1
26	n	0.0	2	0.0	3	0.0
27	1	0.0	23	0.3	24	0.3
28	n	0.0	26	0.3	26	0.3
29	n	0.0	44	0.6	44	0.6
30	n	0.0	25	0.3	25	0.3
31	n	0.0	3	0.0	3	0.0
32	n	0.0	5	0.0	5	0.0

Land Segment	Within 30 days: PROPOSED Prob	Within 30 days: PROPOSED Mean	Within 30 days: EXISTING AND IMPORTS Prob	Within 30 days: EXISTING AND IMPORTS Mean	Within 30 days: PROPOSED EXISTING & IMPORT Prob	Within 30 days: PROPOSED EXISTING & IMPORT Mean
1	n	0.0	13	0.1	13	0.1
2	n	0.0	8	0.1	8	0.1
3	n	0.0	21	0.2	21	0.2
4	n	0.0	16	0.2	16	0.2
5	n	0.0	19	0.2	19	0.2
6	n	0.0	21	0.2	21	0.2
7	n	0.0	24	0.3	24	0.3
8	n	0.0	5	0.1	5	0.1
9	n	0.0	6	0.1	6	0.1
12	n	0.0	12	0.1	12	0.1
13	n	0.0	9	0.1	9	0.1
14	n	0.0	45	0.6	45	0.6
15	n	0.0	52	0.7	52	0.7
16	n	0.0	44	0.6	44	0.6
17	n	0.0	11	0.1	11	0.1
18	1	0.0	23	0.3	24	0.3
19	1	0.0	14	0.1	14	0.2
20	n	0.0	2	0.0	2	0.0
22	n	0.0	1	0.0	1	0.0
23	1	0.0	5	0.1	6	0.1
24	2	0.0	3	0.0	5	0.0
25	7	0.1	n	0.0	8	0.1
26	n	0.0	3	0.0	3	0.0
27	2	0.0	24	0.3	25	0.3
28	n	0.0	27	0.3	27	0.3
29	1	0.0	46	0.6	47	0.6
30	n	0.0	25	0.3	26	0.3
31	n	0.0	3	0.0	3	0.0
32	n	0.0	5	0.0	5	0.1

TABLE IX.F-2 (Cont.)

PROBABILITIES (EXPRESSED AS PERCENT CHANCE) OF ONE OR MORE SPILLS, AND THE EXPECTED NUMBER OF SPILLS (MEANS) OCCURRING AND CONTACTING LAND SEGMENTS OVER THE EXPECTED PRODUCTION LIFE OF THE LEASE AREA, MOST LIKELY VOLUME SCENARIO

Land Segment	------- Within 3 days --------						------- Within 10 days --------						------- Within 30 days --------					
	PROPOSED		EXISTING AND IMPORTS		PROPOSED EXISTING & IMPORT		PROPOSED		EXISTING AND IMPORTS		PROPOSED EXISTING & IMPORT		PROPOSED		EXISTING AND IMPORTS		PROPOSED EXISTING & IMPORT	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
33	n	0.0	16	0.2	16	0.2	n	0.0	24	0.3	24	0.3	n	0.0	24	0.3	25	0.3
34	n	0.0	12	0.1	13	0.1	n	0.0	14	0.1	14	0.2	n	0.0	14	0.2	14	0.2
35	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	4	0.0	4	0.0
36	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0
38	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0
39	n	0.0	5	0.1	5	0.1	6	0.1	33	0.4	37	0.5	14	0.1	48	0.6	55	0.8
40	n	0.0	n	0.0	n	0.0	1	0.0	3	0.0	4	0.0	2	0.0	6	0.1	8	0.1
41	n	0.0	7	0.1	7	0.1	2	0.0	39	0.5	40	0.5	4	0.0	45	0.6	47	0.6
42	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0
43	n	0.0	20	0.2	21	0.2	n	0.0	42	0.6	43	0.6	1	0.0	44	0.6	45	0.6
44	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	2	0.0	2	0.0
45	n	0.0	10	0.1	10	0.1	n	0.0	14	0.1	14	0.1	n	0.0	14	0.1	14	0.1
46	n	0.0	1	0.0	1	0.0	n	0.0	5	0.1	5	0.1	1	0.0	10	0.1	11	0.1
47	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0
48	n	0.0	1	0.0	1	0.0	n	0.0	4	0.0	4	0.0	n	0.0	5	0.0	5	0.0
49	n	0.0	2	0.0	2	0.0	n	0.0	9	0.1	10	0.1	n	0.0	10	0.1	10	0.1
50	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	n	0.0	2	0.0	2	0.0
51	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0
52	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0
54	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0
55	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0
56	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	4	0.0	4	0.0
57	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	6	0.1	6	0.1
58	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	3	0.0	n	0.0	11	0.1	11	0.1
59	n	0.0	n	0.0	n	0.0	n	0.0	5	0.0	5	0.0	n	0.0	12	0.1	12	0.1
60	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	n	0.0	8	0.1	8	0.1
61	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	n	0.0	6	0.1	6	0.1
62	n	0.0	1	0.0	1	0.0	n	0.0	5	0.1	5	0.1	n	0.0	10	0.1	10	0.1
63	n	0.0	2	0.0	2	0.0	n	0.0	9	0.1	9	0.1	n	0.0	15	0.2	15	0.2
64	n	0.0	1	0.0	1	0.0	n	0.0	7	0.1	7	0.1	n	0.0	12	0.1	12	0.1
65	n	0.0	3	0.0	3	0.0	n	0.0	12	0.1	12	0.1	n	0.0	18	0.2	18	0.2

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

TABLE IX.F-3

OIL SPILL PROBABILITY CONDITIONAL MEAN

--Oil spill probability estimates for spills greater than or equal to 1,000, and from 1,000 to 10,000 barrels resulting over the expected production life of OCS Lease Sale 73, from existing Federal leases, and from existing oil transportation in the study area.

	Assumed Amount of oil (Bbbls)	Total number of spills		Prob. of one or more spills (Total)	
		≥1,000	1-10,000	≥1,000	1-10,000
Proposed Action (most likely scenario)	0.29	0.90	0.50	0.59	0.39
(cond. mean scenario)	0.97	3.00	1.67	0.95	0.81
Existing Leases	1.31	3.41	1.95	0.97	0.86
Tanker Transportation of crude oil imports	7.63	4.96	2.52	0.99	0.92
(from Alaska)	6.12	3.98	2.02	0.98	0.87
(from foreign sources)	1.51	0.98	0.50	0.62	0.39

TABLE IX.F-4

OIL SPILL PROBABILITY - CONDITIONAL MEAN

--Oil spill probability estimates for spills greater than or equal to 10,000 barrels resulting over the expected production life of OCS Lease Sale 73, from existing leases, and from existing oil transportation in the study area.

	Assumed Amount of oil (Bbbls)	Total number of spills ≥10,000	Prob. of one or more spills (Total) ≥10,000
Proposed Action (most likely scenario)	0.29	0.40	0.33
(cond. mean scenario)	0.97	1.32	0.73
Existing Leases	1.31	1.46	0.77
Tanker Transportation of crude oil imports	7.63	2.52	0.92
(from Alaska)	6.12	2.02	0.87
(from foreign sources)	1.51	0.50	0.39

TABLE IX.F-5

OIL SPILL PROBABILITY - CONDITIONAL MEAN

-- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) $\geq$1,000 bbls, occurring and contacting targets over the expected production life of the lease area, conditional mean volume scenario.

Target	Within 3 days						Within 10 days						Within 30 days					
	PROPOSED		EXISTING AND IMPORTS		PROPOSED EXISTING & IMPORT		PROPOSED		EXISTING AND IMPORTS		PROPOSED EXISTING & IMPORTS		PROPOSED		EXISTING AND IMPORTS		PROPOSED EXISTING & IMPORT	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	26	0.3	97	3.4	98	3.7	53	0.7	**	7.5	**	8.2	73	1.3	**	9.9	**	11.2
N. Sea Otter Range	1	0.0	5	0.1	7	0.1	3	0.0	11	0.1	14	0.2	5	0.1	16	0.2	20	0.2
S. Sea Otter Range	18	0.2	n	0.0	18	0.2	20	0.2	1	0.0	20	0.2	21	0.2	7	0.1	26	0.3
Sea Otter Range	19	0.2	6	0.1	23	0.3	22	0.2	12	0.1	31	0.4	24	0.3	20	0.2	39	0.5
N. Channel Is.	7	0.1	79	1.6	81	1.7	45	0.6	93	2.7	96	3.3	66	1.1	95	3.0	98	4.1
S. Channel Is.	n	0.0	4	0.0	4	0.0	1	0.0	14	0.2	14	0.2	1	0.0	16	0.2	17	0.2
Channel Islands	7	0.1	79	1.6	81	1.7	46	0.6	94	2.8	97	3.4	66	1.1	96	3.1	99	4.2
Pt. Reyes Mar. Sanct.	2	0.0	77	1.5	78	1.5	3	0.0	79	1.5	79	1.6	3	0.0	79	1.6	80	1.6
Pt. Reyes Wild. Area	3	0.0	87	2.0	87	2.0	3	0.0	87	2.1	88	2.1	3	0.0	88	2.1	89	2.2
Farallon Islands	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	3	0.0	n	0.0	3	0.0	3	0.0
Lease Tern Range	9	0.1	25	0.3	32	0.4	10	0.1	30	0.4	37	0.5	10	0.1	30	0.4	38	0.5
Begg Rock	n	0.0	1	0.0	1	0.0	n	0.0	4	0.0	4	0.0	2	0.0	7	0.1	9	0.1

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

TABLE IX.F-6

OIL SPILL PROBABILITY - CONDITIONAL MEAN

-- Probabilities (expressed as percent chance) of one or more spills, and the expected number of spills (mean) ≥1,000 bbls, occurring and contacting targets over the expected production life of the lease area, conditional mean volume scenario.

Land Segment	Within 3 days						Within 10 days						Within 30 days					
	PROPOSED		EXISTING AND IMPORTS		PROPOSED EXISTING & IMPORT		PROPOSED		EXISTING AND IMPORTS		PROPOSED EXISTING & IMPORTS		PROPOSED		EXISTING AND IMPORTS		PROPOSED EXISTING & IMPORT	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
1	n	0.0	1	0.0	1	0.0	n	0.0	8	0.1	8	0.1	n	0.0	13	0.1	13	0.1
2	n	0.0	1	0.0	1	0.0	n	0.0	5	0.1	5	0.1	n	0.0	8	0.1	8	0.1
3	n	0.0	5	0.0	5	0.0	n	0.0	14	0.2	14	0.2	n	0.0	21	0.2	21	0.2
4	n	0.0	4	0.0	4	0.0	n	0.0	10	0.1	10	0.1	n	0.0	16	0.2	16	0.2
5	n	0.0	8	0.1	8	0.1	n	0.0	13	0.1	13	0.1	n	0.0	19	0.2	19	0.2
6	n	0.0	6	0.1	6	0.1	n	0.0	14	0.2	14	0.2	n	0.0	21	0.2	21	0.2
7	n	0.0	1	0.0	1	0.0	n	0.0	13	0.1	13	0.1	n	0.0	24	0.3	24	0.3
8	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	3	0.0	n	0.0	5	0.1	5	0.1
9	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	3	0.0	n	0.0	6	0.1	6	0.1
12	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	n	0.0	12	0.1	12	0.1
13	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	9	0.1	9	0.1
14	n	0.0	11	0.1	12	0.1	1	0.0	31	0.4	31	0.4	1	0.0	45	0.6	45	0.6
15	1	0.0	46	0.6	46	0.6	1	0.0	52	0.7	52	0.7	1	0.0	52	0.7	52	0.7
16	n	0.0	36	0.4	36	0.4	1	0.0	44	0.6	44	0.6	1	0.0	44	0.6	44	0.6
17	1	0.0	8	0.1	9	0.1	1	0.0	10	0.1	12	0.1	2	0.0	11	0.1	12	0.1
18	2	0.0	11	0.1	12	0.1	3	0.0	20	0.2	22	0.2	4	0.0	23	0.3	26	0.3
19	n	0.0	3	0.0	4	0.0	2	0.0	12	0.1	13	0.1	2	0.0	14	0.1	16	0.2
20	n	0.0	1	0.0	1	0.0	n	0.0	1	0.0	2	0.0	n	0.0	2	0.0	2	0.0
21	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
22	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	2	0.0
23	1	0.0	n	0.0	1	0.0	1	0.0	1	0.0	2	0.0	2	0.0	5	0.1	7	0.1
24	2	0.0	n	0.0	2	0.0	3	0.0	n	0.0	4	0.0	4	0.0	3	0.0	7	0.1
25	13	0.1	n	0.0	13	0.1	14	0.1	n	0.0	14	0.1	14	0.2	n	0.0	14	0.2
26	1	0.0	1	0.0	2	0.0	2	0.0	2	0.0	4	0.0	2	0.0	3	0.0	5	0.1

TABLE IX.F-6 (Cont.)

Land Segment	Within 3 days: PROPOSED Prob	Mean	EXISTING AND IMPORTS Prob	Mean	PROPOSED EXISTING & IMPORT Prob	Mean	Within 10 days: PROPOSED Prob	Mean	EXISTING AND IMPORTS Prob	Mean	PROPOSED EXISTING & IMPORTS Prob	Mean	Within 30 days: PROPOSED Prob	Mean	EXISTING AND IMPORTS Prob	Mean	PROPOSED EXISTING & IMPORT Prob	Mean
27	4	0.0	14	0.1	17	0.2	5	0.0	23	0.3	26	0.3	6	0.1	24	0.3	29	0.3
28	1	0.0	19	0.2	19	0.2	1	0.0	26	0.3	26	0.3	1	0.0	27	0.3	27	0.3
29	n	0.0	23	0.3	23	0.3	1	0.0	44	0.6	45	0.6	2	0.0	46	0.6	48	0.6
30	n	0.0	14	0.2	14	0.2	n	0.0	25	0.3	25	0.3	1	0.0	25	0.3	26	0.3
31	n	0.0	2	0.0	2	0.0	n	0.0	3	0.0	3	0.0	n	0.0	3	0.0	3	0.0
32	n	0.0	2	0.0	2	0.0	n	0.0	5	0.0	5	0.0	n	0.0	5	0.0	5	0.1
33	1	0.0	16	0.2	16	0.2	1	0.0	24	0.3	25	0.3	1	0.0	24	0.3	25	0.3
34	1	0.0	12	0.1	13	0.1	2	0.0	14	0.1	15	0.2	1	0.0	14	0.2	15	0.2
35	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	4	0.0	5	0.0
36	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0
37	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
38	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0
39	n	0.0	5	0.1	5	0.1	19	0.2	33	0.4	46	0.6	40	0.5	48	0.6	69	1.2
40	n	0.0	n	0.0	n	0.0	3	0.0	3	0.0	6	0.1	7	0.1	6	0.1	12	0.1
41	n	0.0	7	0.1	7	0.1	7	0.1	39	0.5	43	0.6	13	0.1	45	0.6	52	0.7
42	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0
43	1	0.0	20	0.2	21	0.2	2	0.0	42	0.6	43	0.6	2	0.0	44	0.6	45	0.6
44	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	2	0.0	2	0.0
45	n	0.0	10	0.1	10	0.1	n	0.0	14	0.1	14	0.1	n	0.0	14	0.1	14	0.2
46	n	0.0	1	0.0	1	0.0	n	0.0	5	0.1	5	0.1	2	0.0	10	0.1	12	0.1
47	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	2	0.0
48	n	0.0	1	0.0	1	0.0	n	0.0	4	0.0	4	0.0	n	0.0	5	0.0	5	0.1
49	n	0.0	2	0.0	2	0.0	1	0.0	9	0.1	10	0.1	1	0.0	10	0.1	11	0.1
50	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	n	0.0	2	0.0	3	0.0
51	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0
52	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0
53	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
54	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	2	0.0
55	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0
56	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	4	0.0	4	0.0
57	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0	6	0.1	6	0.1

TABLE IX.F-6 (Cont.)

Land Segment	Within 3 days PROPOSED		Within 3 days EXISTING AND IMPORTS		Within 3 days PROPOSED EXISTING & IMPORT		Within 10 days PROPOSED		Within 10 days EXISTING AND IMPORTS		Within 10 days PROPOSED EXISTING & IMPORTS		Within 30 days PROPOSED		Within 30 days EXISTING AND IMPORTS		Within 30 days PROPOSED EXISTING & IMPORT	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
58	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	3	0.0	n	0.0	11	0.1	11	0.1
59	n	0.0	n	0.0	n	0.0	n	0.0	5	0.0	5	0.0	n	0.0	12	0.1	12	0.1
60	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	n	0.0	8	0.1	8	0.1
61	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	n	0.0	6	0.1	6	0.1
62	n	0.0	1	0.0	1	0.0	n	0.0	5	0.1	5	0.1	n	0.0	10	0.1	10	0.1
63	n	0.0	2	0.0	2	0.0	n	0.0	9	0.1	9	0.1	n	0.0	15	0.2	15	0.2
64	n	0.0	1	0.0	1	0.0	n	0.0	7	0.1	7	0.1	n	0.0	12	0.1	12	0.1
65	n	0.0	3	0.0	3	0.0	n	0.0	12	0.1	12	0.1	n	0.0	18	0.2	18	0.2

Note: n = less than 0.5 percent; ** - greater than 99.5 percent. Segments with less than 0.5 percent probability of one or more contacts within 30 days are not shown.

G. Federal and California Ambient Air Quality Standards

TABLE IX.G-1

FEDERAL AND CALIFORNIA/AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	California Standards[1] Concentration[3,6]	National Standards[2] Primary[3,4]	National Standards[2] Secondary[3,5]
Oxidant (Ozone)	1 Hour	0.10 ppm ($200\ \mu g/m^3$)	$235\ \mu g/m^3$ (0.12 ppm)	Same as Primary
Carbon Monoxide	12 Hours	10 ppm ($11\ mg/m^3$)		
	8 Hours	--	$10\ mg/m^3$ (9 ppm)	Same as Primary
	1 Hour	40 ppm ($46\ mg/m^3$)	$40\ mg/m^3$ (35 ppm)	
Nitrogen Dioxide	Annual Average	--	$100\ \mu g/m^3$ (0.05 ppm)	Same as Primary
	1 Hour	0.25 ($470\ \mu g/m^3$)	--	--
Sulfur Dioxide	Annual Average	--	$80\ \mu g/m^3$ (0.03 ppm)	--
	24 Hours	0.05 ppm[7,8] ($131\ \mu g/m^3$)	$365\ \mu g/m^3$ (0.14 ppm)	--
	3 Hours	--	--	$1,300\ \mu g/m^3$
	1 Hour	0.5 ppm[8] ($1,310\ \mu g/m^3$)	--	--
Suspended Particulate Matter	Annual Geometric Mean	$60\ \mu g/m^3$	$75\ \mu g/m^3$	$60\ \mu g/m^3$
	24 Hours	$100\ \mu g/m^3$	$260\ \mu g/m^3$	$150\ \mu g/m^3$
Sulfates	24 Hours	$25\ \mu g/m^3$[8]	--	--
Lead	30-Day Average	$1.5\ \mu g/m^3$	--	--
	3-Month Average	--	$1.5\ \mu g/m^3$	--

Pollutant	Averaging Time	California Standards[1] Concentration[3,6]	National Standards[2] Primary[3,4]	Secondary[3,5]
Hydrogen Sulfide	1 Hour	0.03 ppm ($42\ \mu g/m^3$)	--	--
Hydrocarbons (corrected for Methane)	3 Hours (6-9 a.m.)	--	$160\ \mu g/m^3$ (0.24 ppm)	Same as Primary
Ethylene	8 Hours 1 Hour	0.1 ppm 0.5 ppm	--	--
Visibility-Reducing Particles	One Observation	Insufficient to reduce the prevailing visibility to less than 70%		

Notes:

1. California standards are values that are not to be equaled or exceeded.

2. National standards, other than those based on annual geometric means, are not to be exceeded more than once per year.

3. Concentration is expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm of mercury. All measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of Hg (1013.2 millibars). In this table, ppm refers to ppm by volume, or micromoles of pollutant per mole of gas.

4. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect public health. Each State must attain the primary standards no later than 3 years after the State's implementation plan is approved by the Environmental Protection Agency (EPA).

5. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse affects of a pollutant. Each State must attain the secondary standards within a "reasonable time" after their implementation plan is approved by the EPA.

H. DOI Air Quality Regulations

Outer Continental Shelf (OCS) emissions are regulated by the U.S. Department of the Interior (DOI). These regulations establish a review process for offshore emission sources designed to prevent adverse effects on onshore air quality (30 CFR 250.57). DOI has established emission exemption levels for carbon monoxide (CO), total suspended particulates (TSP), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and hydrocarbons (HC). Facilities with projected emissions below these levels are exempt from further regulatory review. The exemption level for CO is

$$E = 3400\ D^{2/3}$$

where E is the emission rate in tons per year and D is the distance of the proposed facility from shore in statute miles. For TSP, NO_x, SO_2, and HC the exemption level is

$$E = 33.3\ D$$

The exemption levels apply to any offshore installation and related storage and processing facilities.

For any facility with projected emissions above the exemption levels, computer modeling needs to be performed to determine whether the facility would cause significant air quality impacts. If maximum calculated concentrations are below the DOI Significance Levels (Table IX-H-1), no further regulatory review would be required. If concentrations exceed the DOI Significance Levels, the applicant would be required to apply Best Available Control Technology (BACT), an emission limitation based on maximum degree of reduction considering energy, environmental, and economic impacts. For TSP and SO_2, additional controls may be required if projected concentrations exceed the DOI Maximum Allowable Increases in an attainment area (designated region in which existing pollution levels meet Federal ambient standards). The Maximum Allowable Increases are listed in Table IX-H-2.

If projected emissions from an OCS facility significantly affect onshore air quality of a nonattainment area (designated region in which pollution levels do not meet Federal ambient standards), the emissions shall be "fully reduced" (45 FR 15145). If this cannot be accomplished through the application of BACT, additional reductions would be required through the application of additional emission controls or through the acquisition of offshore or onshore emission offsets.

Any new OCS facility that is projected to result in significant onshore air quality impacts due to cumulative interaction with preexisting OCS facilities in the area would be subject to emission limitations. This would be the case even if the individual source by itself produces no significant impacts.

TABLE IX.H-1

DOI SIGNIFICANCE LEVELS[1]

Air Pollutant	Averaging Time				
	Annual	24-hr	8-hr	3-hr	1-hr
Sulfur Dioxide (SO_2)	1	5	--	25	--
Total Suspended Particulates (TSP)	1	5	--	--	--
Nitrogen Oxides (NO_x)	1	--	--	--	--
Carbon Monoxide (CO)	--	--	500	--	2,000

1. All concentrations are in micrograms per cubic meter.
   -- indicated no standard exists.

   Source: 30 CFR 250.57

Table IX-H-2 DOI Maximum Allowable Increments[1]

Air Pollutant	Annual Average[2]	24-Hour Maximum	3-Hour Maximum
Class I[3]			
TSP	5	10	--
SO_2	2	5	25
Class II			
TSP	19	37	--
SO_2	20	91	512
Class III			
TSP	37	75	--
SO_2	40	182	700

1. Concentrations in micrograms per cubic meter.
   -- indicates no standard.

2. TSP - geometric average; SO_2 - arithmetic average.

3. Classes established under EPA's Prevention of Significant Deterioration program.

Source: 30 CFR 250.57

I. Resource Estimates for Environmental Impact Statements

With the initiation of streamlining, resource estimates developed by the USGS Resource Appraisal Group (RAG) served as the basis for sale EIS'. The RAG estimates of undiscovered recoverable resources differ from the method previously used in prior EIS' in several important respects.

1. The RAG resource estimates are not developed solely on the basis of identified prospects. The estimates include a "learning curve" and subjective assessments of future field types and size distributions. That is, in frontier areas RAG assumes knowledge gained from early exploration efforts wll be used to direct future exploration and development activities. The estimates include discoveries that will be made from all future rounds of exploration.

2. The RAG estimates include resources that may exist in traps and plays that are very difficult, if not impossible to identify with current technology or techonlogy which can reasonably be assumed to be developed in the near term.

3. The RAG estimates are for the entire OCS area, including State waters and leased Federal OCS.

4. The RAG assessments of oil and nonassociated gas are done independently of one another. The assessments are not conditional upon the existence of hydrocarbons (oil and/or nonassociated gas) but on the existence of the particular fluid being assessed.

5. The RAG assessments are based upon areas termed "provinces." Various assumptions are necessary to aggregate the RAG province assessments for areas corresponding to planning areas.

Realizing the above differences exist between the previous and RAG methodologies, USGS modified the RAG assessments in the following manner.

1. The RAG province assessments of resources were aggregated assuming independence between the occurrence of oil and gas within and among provinces to an estimate for the planning area. This is possible only with the conditional mean resource level. The resultant estimate is the conditional mean estimate of undiscovered recoverable resources given commerical hydocarbons are present for the planning area.

2. Next, USGS on the basis of a percentage allocation removes the resources estimated to exist in the State waters.

3. The Minerals Management Service estimates of resources for existing leases are removed assuming statistical independence between leased and unleased tracts.

4. Removal of the resources estimated to exist within State lands and Federal leases is assumed to have no affect upon the probability of commerical hydrocarbons existing within the remaining area.

The end product of these modifications is the conditional mean estimate for undiscovered oil and gas resources given hydrocarbons are present for the unleased Federal OCS portion of the planning area. Due to the inclusion of unidentified prospects and a learning curve in the generation of these estimates, resources are included that cannot reasonably be assumed to be discovered as a result of the specific sale being addressed in the EIS, for this reason, it was decided to use this estimate for the "high case" scenario in the EIS. A "most likely" estimate of resources to be discovered and developed as a result of the sale was made taking into account the knowledge of the particular area's geology, economic considerations, exploration history, and potential learning curve in conjunction with finding rates in other OCS areas worldwide.

J. Glossary

Acute	-	short term, severe or intense impacts may be felt, bioassays of generally 96 hours or less.
Anadromous fish	-	fish that migrate up rivers from the sea to breed in fresh water.
Anomaly	-	deviation from normal condition.
Anthropogenic	-	coming from human sources.
Benthic	-	bottom dwelling.
Benthic macroinvertebrate	-	animals such as worms, clams, or crabs which are large enough to see without the aid of a microscope.
Biomass	-	weight of living organisms.
Carrying capacity	-	the maximum number of weight of individuals that can exist in a given habitat.
Cetacean	-	any of an order (Cetacea) of aquatic mostly marine mammals including the whales, dolphins, porpoise and related forms with large head, fishlike nearly hairless body, and paddle-shaped forelimbs.
Critical habitat	-	an area that is essential to the conservation of a species.
Demersal	-	bottom dwelling.
Endangered	-	refers to any species which is in danger of extinction throughout all or a significant portion of its range and has been officially listed by the appropriate Federal or State agency; a species is determined to be endangered (or threatened) because of any of the following factors: a) the present or threatened destruction, modification, or curtailment of its habitat or range; b) overutilization for commercial, sporting, scientific, or educational purposes; c) disease or predation; d) the inadequacy of existing regulatory mechanisms; or e) other natural or man-made factors affecting its continued existence.
Epibenthic organism	-	those organisms attached to, or living on a substrate as opposed to those which burrow and live in the substrate.
Epiphyte	-	a plant growing attached to another plant.

Fauna - animals, especially the animals of a particular region or time.

Fledge - to rear until ready for flight or independent activity.

Fledgling - a young bird just fledged.

Flyway - an established air route of migratory birds.

Gross regional product - total value added generated from all sectors in the regional economy including government and households. (See value added.)

Haul-out area - specific locations where pinnipeds come ashore and concentrate in numbers to rest, breed, and/or bear young.

Hypothermia - subnormal temperature of the body, usually due to excessive heat loss.

Indirect (socio-economic) effects - caused by activities which are stimulated by an action but not directly related to it.

Mariculture - the breeding or growth of marine animals and plants to increase their stocks.

Microcrustacean - any relatively small crustacean (may range from microscopic to a few inches in size) including organisms such as shrimp, crabs, beach hoppers (amphipods), copepods and other similar groups.

Mysids - small shrimp-like organisms.

Ovoviviparous - producing eggs that hatch within the female's body.

Phytoplankton - plant (photosynthetic) plankton.

Pinniped - any of a suborder (Pinnipedia) of aquatic carnivorous mammals (e.g., seals, sea lions) with all four limbs modified into flippers.

Purse seine - a fishing net that is pursed or drawn into the shape of a bag to enclose the catch.

Rare - refers to any species whose continued existence is threatened by one or more conditions and has been officially listed by the appropriate State agency; a species is determined to be rare because of any of the following conditions: a) the species is confined to a

relatively small and specialized habitat and is incapable of adapting to different environmental conditions; b) the species, although found in other parts of the world, is nowhere abundant; c) the species is so limited that appreciable reduction in range, numbers, or habitat would cause it to become endangered; or d) the species would become endangered if current management and protection programs were diminished to any degree.

Rookery - the nesting or breeding grounds of gregarious (i.e., social) birds or mammals; also a colony of such birds or mammals.

Subtidal - generally considered to be that part of the ocean bottom not uncovered by tidal action.

Threatened - refers to any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and has been officially listed by the appropriate Federal agency; criteria for determination of threatened status can be found under "endangered".

Trawl - a large, tapered fishing net of flattened, conical shape that is typically towed along the sea bottom.

Trophic - feeding, trophic levels refer to the hierarchy of organisms from photosynthetic plants to carnivores such as man.

Upwelling - movement of subsurface water to the surface of the ocean, caused by meteorological and physical phenomena.

Value added - for a given enterprise, the market price of goods completed, less the cost of purchased materials. Gross value added includes compensation to employees, profits, taxes, rents, interest, and reserves for depreciation.

Xenobiotic - compound not usually associated with living organisms.

Zooplankton - animal plankton, dependent on phytoplankton for food source.

K. Abbreviations

AAPG	American Association of Petroleum Geologists
AAQS	Ambient Air Quality Standards
API	American Petroleum Institute
ASBS	Areas of Special Biological Significance
BAST	Best Available and Safest Technologies
BCDC	Bay Conservation and Development Commission
BLM	Bureau of Land Management
BOD	Biological Oxygen Demand
CalCOFI	California Cooperative Oceanic Fisheries Investigations
CARB	California Air Resources Board
CCA	California Coastal Act
CCC	California Coastal Commission
CDFG	California Department of Fish and Game
CDI	Coastal Dependent Industry
CDOG	California Division of Oil and Gas
CEP	Council of Environmental Protection
CEPEX	Controlled Ecosystem Pollution Experiment
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMP	Coastal Management Program
COD	Chemical Oxygen Demand
CSLC	California State Lands Commission
CZMA	Coastal Zone Management Act
DEIS	Draft Environmental Impact Statement
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DWT	Dead Weight Ton
EA	Environmental Assessment
E&D	Exploration and Development Report
EIS	Environmental Impact Statement
EOR	Enhanced Oil Recovery
EPA	U.S. Environmental Protection Agency
FACSFAC	Fleet Area Control and Surveillance Facility
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulation Commission
FIRS	Failure and Inventory Reporting System
FONSI	Finding of No Significant Impact
FOSI	Finding of Significant Impact
FR	Federal Register
FWPCA	Federal Water Pollution Control Act
FWS	U.S. Fish and Wildlife Service
GS (also USGS)	U.S. Geological Survey
LCP	Local Coastal Programs
LNG	Liquified Natural Gas
MERL	Marine Ecosystems Research Laboratory
MMS	Minerals Management Service
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Science
NEPA	National Environmental Policy Act

NERBC/RALI	New England Rivers Basins Commission/Resources and Land Investigations Program
NMFS	National Marine Fisheries Service
NMRC	National Maritime Research Center
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant and Discharge Elimination System
NPS	National Park Service
NSF	National Science Foundation
NTLs	Notices to Lessees and Operators
OBERS	Office of Business Economics and the Economic Research Service (OBE-Dept. of Commerce) (ERS-Dept. of Agriculture)
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OS&T	Offshore Storage and Treatment
PG&E	Pacific Gas & Electric Company
PGT	Pacific Gas Transmission Company
PMTC	Pacific Missile Test Center
POCS	Pacific Outer Continental Shelf
PTC	Petroleum Transportation Committee
RSOFOD	Regional Supervisor Offshore Field Operations Division
RRT	Regional Response Team
RIMS	Regional Industrial Multipler System
RTWGs	Regional Technical Working Groups
SALM	Single Anchor Leg Mooring System
SID	Secretarial Issue Document
SLO	San Luis Obispo
USCG	U.S. Coast Guard
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS (also GS)	U.S. Geological Survey
VOC	Volatile Organic Compounds
WSMC	Western Space and Missile Center

L. Units of Measure

b/d	= barrels per day
BBO	= billion barrels of oil
bcd	= barrels per calendar day
Btu	= British thermal unit
bbl	= barrel
BP	= years before present
bcf	= billion cubic feet
cm	= centimeter
dBA	= decibels audible
dwt	= dead weight ton
ha	= hectares
hr	= hour
km	= kilometer
l	= liter
lb.	= pound
m	= meter

maxi.	= maximum
mg	= milligrams
mgd	= million gallons per day
MW	= megawatt
MWe	= megawatt (electric)
ng	= nannogram
nm	= nautical mile
ppb	= parts per billion
pphm	= parts per hundred million
ppm	= parts per million
ppt	= parts per thousand
sp.	= species
TCFG	= trillion cubic feet gas
ug	= microgram
$^{o}/oo$	= parts per thousand

M. TECHNICAL PAPERS FOR PROPOSED SALE NO. 73

To obtain a copy of the following POCS Technical Papers

Yamasaki, R., 1983. Hypothecical Oil and Gas Transportation Scenario of Proposed OCS Lease Sale No. 73 Offshore Central California. POCS Technical Paper 83-1

Form and Substance Inc., 1983. Air Quality Impact Proposed OCS Lease No. 73 Offshore Central California, POCS Technical Paper 83-2

Fernandez, J., 1983. Economic Impacts of Proposed OCS Lease Sale No. 73, POCS Technical Paper 83-3

Contact: Minerals Management Service
Pacific OCS Region
1340 West 6th Street
Los Angeles, California 90017

La Belle, R.P., Lan Fear, K.J., and Karpas, R.M. 1983. An oil spill risk analysis for the Central and Northern California (Proposed Sale 873) Outer Continental Shelf Lease area. Prepared by Minerals Management Service, Environmental Modeling Group, Reston, Virginia. Report OSTA-73

To obtain a copy of this report:

Contact: Environmental Modeling Group
Minerals Management Service
Mail Stop 644
12201 Sunrise Valley Drive
Reston, Virginia

Charge: Cost of printing.